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United States/Canada

ELECTRICITY EXCHANGES

May 1979

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February 1979

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February 1979

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UNITED STATES/CANADA ELECTRICITY EXCHANGE STUDY

PREFACE

In January 1978, Prime Minister Trudeau and Vice President Mondale agreed that Canada and the United States would undertake a joint study to examine the potential for increasing international electricity exchanges between the two countries. The United States Department of Energy and the Canadian Department of Energy, Mines, and Resources were given the responsibility for organizing, drafting and submitting a report on this subject. A regional approach, using data supplied by United States and Canadian utilities, has been adopted in order to identify specific opportunities, and obstacles and constraints to these opportunities, which might be overlooked if addressed only at an aggregated, national perspective. Historically, it has been left to the electric utilities to identify electricity exchange opportunities and to construct the necessary facilities to take advantage of these opportunities. Even though government regulatory procedures control the construction of such international facilities, it is at the utility level that actual exchanges occur.

The participants in the study were regional representatives of the electrical utilities near the United States - Canadian border; Federal officials of both countries and representatives of the Canadian provincial governments except for Quebec which declined an invitation to participate. Observers from Quebec and Hydro Quebec participated in organizational meetings. The actual participants by name are identified in Appendix A.

The history of electric power exchange between the United States and Canada dates back to 1901, when a 12 kilovolt transmission line was

built across the border at Niagara Falls. The purpose of this early interconnection was to market (in the United States) the hydroelectric resources of Canada. The growth of electric power systems and the development of high voltage transmission systems during the following decades have encouraged more interconnections between Canadian and United States electric utilities. Almost all electricity transactions now are between utility systems rather than between specific power plants in one country and electricity users in the other. Today, over 100 interconnecting lines, ranging from 115 to 765,000 volts, cross the border between the two nations. These lines can transport over 8,000 megawatts of electric power. Electricity exchanges between the United States and Canada reached 22 billion kilowatt hours in 1977. These exchanges have enabled both countries to reduce their dependence on foreign oil and achieve more efficient and reliable electric energy operations.

The United States and Canada have been cooperating in all areas of energy exchange for many years. Electrical energy has been chosen to be the focus of this study because substantial means for exchanges between the two countries already exist and increased exchanges offer benefits that have not yet been fully exploited. This is a period of uncertainty regarding the availability of energy sources, projections of future load growth, and the pace which generating capacity can or should be expanded. There may be some significant bilateral benefits from additional interconnections because of the "buffers" which they represent against domestic imbalances.

Cooperation between the United States and Canada in the exchange of electric power has become both routine and necessary. While recognizing the uncertainties in the energy situation, the United States and Canada have resolved to explore the potential benefits of in-

creased international electricity transactions and have identified recommendations which can be acted upon by the governments and operating electric utilities.

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1. EXECUTIVE SUMMARY AND RECOMMENDATIONS

SUMMARY

This study was initiated in early 1978 to examine the potential for increased international electricity transfers between the United States and Canada. This report was prepared by the United States Department of Energy and the Canadian Department of Energy, Mines, and Resources based on detailed reports developed by utilities within the two countries. The regions of principal interest in this study are shown in Figure 1-1.

The organization for the supporting regional reports, included representatives from the four regional Electric Reliability Councils on the United States - Canadian border (Northeast Power Coordinating Council, East Central Area Reliability Coordination Agreement, Mid-Continent Area Reliability Coordination Agreement, and Western Systems Coordinating Council); the Alaska Power Administration; all Canadian electric utilities and their provincial governments except Quebec; the United States Department of Energy; the Canadian Department of Energy, Mines, and Resources; the Canadian Department of External Affairs and the Canadian Department of Regional Economic Expansion. The Quebec provincial government declined an invitation to participate, however, observers from Quebec and Hydro Quebec did participate in several organizational meetings.

The study addresses the following areas:

- Existing and future planned electric power interconnection capability;
- Regional load and resource forecasts;

Principal Regions of Interest

FIGURE 1-1

SCALE:
 1/24,000,000
 1 in. = 95.5 mi.
 1 cm. = 60.5 km.

- Opportunities and incentives for increased electricity exchanges;
- Obstacles and constraints to expanded electricity exchanges; and
- Procedures for ameliorating constraints.

Electricity exchanges between the United States and Canada provide a wide variety of benefits to the citizens and electric utilities of both countries. These benefits include:

- Reserve Sharing: agreements for mutual generation support such that new power plant requirements are decreased;
- Diversity Exchanges: non-coincident peak loads which allow utilities to "share" generation and realize economic benefits;
- Surplus Energy Sales: the existence of secondary markets (including storage) to utilize energy from renewable resources that would otherwise be wasted (e.g., run-of-river hydro, and in the future tidal and wind);
- Economy Interchange: the interchange of electricity, between two utilities, which takes place when the exchange will result in a reduction in costs to the consumers in both utilities' areas;
- Economies of Scale: the ability to take advantage of per unit cost reductions through the installation of larger facilities;

- Coordinated Planning and Operation: cooperation between utilities, principally in generation facility planning, operation, and maintenance, to reduce investment requirements and distribute maintenance outages such that system operations are optimized;
- Reduction in Oil Consumption: made possible through more efficient use of generation and fuel resources; efficient use of energy from renewable resources (hydro, wind, solar, etc.); and
- Local Economic Benefits: creation of jobs and a larger tax base resulting from local projects for the selling system.

In general, the potential benefits to be obtained from increased interconnections derive principally from comparing regional load and resource forecast data. In the case of the United States and Canada, economy interchange, seasonal diversity, and surplus hydro have been the principal "resources" providing the basis for obtaining one or more of these benefits. While present load forecasts do not indicate any serious shortages in either country based on National Electric Reliability Council (NERC) regional data, there may be significant opportunity to increase exchanges to the benefit of both the utility and customer. During the past ten years, the United States has imported significant quantities of electricity from Canada. From utility data supplied for this study, it appears that increases in such imports will continue.

The electric energy supply systems in the United States and Canada have both similarities and differences; the differences arise principally from characteristics in ownership, organizational structures, operating procedures and regulation. There is exten-

sive cooperation between Canadian and United States utilities including the active membership of four provincial Canadian electric utilities in regional Electric Reliability Councils, which in turn are members of NERC, predominantly a United States organization. While the majority of bulk electric energy systems in Canada are provincially owned, most major utilities in the United States are investor-owned. Federal regulatory controls over utility operations are significantly greater in United States than in Canada. Regulatory jurisdiction over the export of electric energy is a federal government responsibility in both countries.

At present, there are over 100 transmission lines between Canada and the United States providing more than 8,000 megawatts of power transfer capability. This total transfer capability reflects a small percentage of the total generating capability in either country, however, its significance is much greater on a regional basis. This international transfer capability on a regional basis is depicted in Figure 1-2. Approximately one-half of the transfer capability exists in the Eastern Region, principally between Ontario Hydro in the Province of Ontario, and utilities in the states of New York and Michigan.

Currently, several additional high voltage transmission interconnections between Canada and the United States are in planning, licensing or construction stages. If those lines planned, are placed in service by 1985, the incremental addition to the present power transfer capability would be approximately 3,240 megawatts or a 30 percent increase. The principal new lines would be between Ontario Hydro and New York State utilities in the Buffalo area, and between Manitoba Hydro and North-Central states in the United States. These additions would bring the total power transfer capability in 1985 between Canada and the United States to over 11,000 megawatts, which will be 1.4 percent of the 1985

FIGURE 1-2

**EXISTING INTERNATIONAL POWER LINES — 69 kV AND ABOVE
GEOGRAPHICAL DISTRIBUTION**

*Estimated Power Transfer Capability.

**Two of these lines have a power transfer capability of 75 megawatts (25 Hz).

planned generating capability in the United States. Similarly, the percentage of Canada's generating resources would be approximately 10 percent.

Potential for increased United States - Canadian electricity transaction exists and arises both from load and generation diversities and from differences in generation types or fuels. A more specific description of these opportunities follows:

- Maritime Provinces/New England States:

Surplus electricity from hydroelectric or tidal developments, or other major hydro developments in geographical regions which are near the Maritimes. In addition, there is the possibility of short-term firm sales from the large nuclear unit presently being constructed in New Brunswick.

- Quebec Province/New England Region and New York State:

Surplus electricity from hydroelectric development at the James Bay site or from Labrador, and the winter peaks in Quebec and summer peaks in New York State and New England offer significant potential for increased seasonal diversity exchanges.

- Ontario Province/States of New York and ECAR:

Increased operational coordination may stimulate economic exchanges, for example, the using of coal-fired generation in Ontario may reduce oil consumption in New York, Michigan, and utilities further south. In addition, it appears there may be significant possibilities for seasonal diversity exchanges between Ontario and utilities to the south of New York and Michigan, and for sales of firm power and energy resulting from the

advancement of generation in Ontario, if certain transmission limitations can be overcome.

- Manitoba Province/North-Central States:

Increased exchange of seasonal diversity electricity is possible due to summer peaking in Minnesota and Nebraska, and winter peaking in the Manitoba area. A large amount of undeveloped hydroelectric resources exist in northern Manitoba and consideration is being given to early development for export to the United States. In particular, negotiations regarding a 1,100 megawatt development at Conawapa are currently in progress between the United States Western Area Power Administration and the Manitoba Hydro utility.

- Saskatchewan Province/North Dakota:

Some exchange of seasonal diversity energy is possible.

- Alberta Province/Northwest States:

No major transmission ties exist at present, however, electricity interchanges may take place through British Columbia. Also, a significant quantity of hydro in the Northwest United States may be complementary generation for the fossil steam generators in Alberta.

- British Columbia Province/Northwest States:

No additional plans exist for strengthening United States - Canadian interties. Currently, transmission limits within the United States can restrict the imports of electricity from Canada.

- Yukon Territory and British Columbia Province/Alaska:

One small Alaska community receives its utility service

from British Columbia, but otherwise there are no present or planned electricity exchanges across the Alaska/Canada border. Need for and justification of future interconnections will depend on future economic growth and resource developments in Alaska and northern Canada. Hydroelectric and coal resources in Alaska and northern Canada would be logical power sources.

While numerous opportunities do exist for increased transactions between the United States and Canada, there are also many obstacles and constraints in both the United States and Canada which may delay or limit the extent to which these benefits are realized. Some of the more significant obstacles and constraints identified by United States utilities include:

- Overlapping state and federal jurisdiction;
- Extensive and lengthy regulatory procedures which result in uncertainty and project delays;
- Economic uncertainties regarding construction and operating costs;
- Public acceptance problems related to electricity exports;
- Lack of a clear national policy statement; and
- Potential for federal curtailment of export power in national emergencies.

Likewise, Canadian utilities indicated the following obstacles and constraints:

- Canadian export pricing policies that appear overly restrictive thus minimizing cost savings to a purchasing utility;
- Time consuming public and regulatory review processes;
- Financial/economic uncertainties; and
- Significant problems of public acceptance.

In conclusion, while these constraints and obstacles are similar to the problems experienced by utilities within the framework of their own service or regional territory, they are perceived by utilities to be of greater magnitude and complexity for international transactions.

RECOMMENDATIONS

The study committee's analysis of the information gathered in the preparation of this report, especially that contained in the regional reports has demonstrated that increased mutual benefits may be realized from increased United States/Canada electricity exchanges. There appear to be several specific actions that electric utilities and the governmental regulatory bodies in both nations could take to ensure that such benefits are maximized for individual consumers in both countries.

Electric utilities operating in the vicinity of the United States/Canadian border should:

- Ensure that utility system planning and operation coordination occur to the maximum possible extent.

- Foster and expand the sharing of utility system technical data and information such that load diversities and other such mutual advantages may be evaluated.
- In the United States develop transmission service (wheeling) rates such that utilities not directly adjacent to the border are encouraged to participate in international electricity exchanges.
- Develop economy interchange rates that provide for the fair sharing of any benefit(s) realized.
- Ensure that applications for international transmission lines and energy exports are filed in a timely manner such that all regulatory requirements can be met without delaying the project.

Federal, State or Provincial governments and regulatory agencies as appropriate should:

- Provide clear statements of government policies regarding the export of electricity, and in particular, the conditions governing firm exports.
- Effect increased communications and coordination among the regulatory agencies involved in the licensing of international electric transmission lines and the export of electricity and between such agencies and electric utilities.
- Facilitate and encourage concurrent regulatory licensing proceedings to the maximum extent possible.

- Prepare and publish concise guides for regulatory processes involved in international electricity exchanges such that electric utilities and others are fully informed as to all requirements, especially filing requirements and lead times.
- Develop an appropriate public information program such that the public will have full knowledge of the value of international electricity exchanges.
- Ensure that the pricing policies for international electricity transactions provide incentives to maximize exchange opportunities and that any realized benefits are shared fairly.
- In the United States assure that regulatory procedures permit the inclusion of purchased power costs in any automatic rate adjustment clause when such purchases result in the more economic and efficient operation of a utility system.

These recommendations, and the benefits to be derived from their implementation, are not unique to international transactions. In almost every case they apply equally to domestic electricity transactions in both countries. The fact that an international border must be crossed is apparently perceived by Canadian and United States utilities as an impediment to increased electricity exchanges. The study team concludes that while these concerns appear to be exaggerated, this psychological barrier could be reduced by more effective utility and governmental coordination with emphasis on the open exchange of information among all parties concerned.

2. BACKGROUND

HISTORY OF ELECTRICITY EXCHANGES

In 1901, the first electric power transmission line between Canada and the United States was built at Niagara Falls. This interconnection enabled abundant Canadian hydroelectric power to be marketed in the United States. This historical event set the stage for continued exchanges of Canadian- and United States-developed hydro resources (which were in close proximity to the border), in a climate of international cooperation and coordination. In fact, today there are over 100 international power lines, ranging in voltage from 115 to 765,000 volts. There are some twenty-nine bulk power interties rated at 69 kilovolts or higher between the Provinces of New Brunswick, Ontario, Quebec, Manitoba and British Columbia and the United States. There are also over 75 other interconnections which supply local loads or industrial plants near the border. During 1977, total electric energy exported from the United States to Canada was 2,698 gigawatt hours and exports to the United States from Canada were 19,956 gigawatt hours over these transmission lines. The Canadian exports amount to approximately 6.3 percent of Canada's net electricity generation.

Figure 2-1 depicts the United States and Canadian electric interchanges for the past ten years. During the mid sixties, imports and exports by both countries were roughly in balance. However, in recent times, there has been a strong trend toward ever-increasing exports to the United States.

During the first part of this century, the principal reason for constructing these international electric transmission lines was to sell hydro energy not needed at that time in Canada. In fact, many

FIGURE 2-1

IMPORTS AND EXPORTS OF ELECTRICAL ENERGY
BETWEEN CANADA AND U.S.A.

hydroelectric developments in Canada were originally built using funds from long-term contracts with United States utilities. Today, Canada remains highly dependent on hydroelectric generating resources (which provide 70 percent of total electric energy needs). Surplus energy from hydroelectric facilities is sometimes available during periods of high river flow. "Export sales of such energy on an at-will when-available basis can provide a hydro system with an important contribution to its net income. The energy is produced from water that would otherwise be spilled unused over the dams, and the incremental cost of generating and transmitting it is negligible."¹ Variations in peak loads due to seasonal temperature differences provide the opportunity for the international exchange of electricity from thermal plants. In addition to this economic incentive for building transmission lines across the border, the lines made both systems more reliable, providing Canadians and Americans with an improved standard of living. The assured supply of electricity fostered growth and expansion of the railroad, mineral and pulp and paper industries in addition to the obvious conveniences to residential users.

International interconnections offered other advantages, such as:

- Sharing generating capacity reserves so that total reserve requirements may be reduced;
- Movement of surplus or lower cost energy between systems resulting in fuel savings;
- Reduction of cost per unit of output as a result of installing larger, more efficient generating facilities - taking advantage of economies of scale;

- Lowering dependence of a given region on a single fuel source (e.g., imported oil) for electrical generation by providing access to alternative sources of electrical energy;
- Provides capability for a utility system in one country to render emergency capacity and energy support to a utility system in the other.
- Provision of electricity supply to communities in the United States or Canada which are in close proximity to supply centers of the other country; and
- Ability to take advantage of seasonal load variations in the regions on both sides of the border. Canadian utilities are winter peaking whereas many United States utilities are summer peaking.

The geographic, demographic, natural resource and seasonal diversities between the United States and Canada have been cited as incentives for the historical development of electricity exchanges.

The areas of governmental jurisdiction in both nations have influenced the progress of electricity exchanges. "Canada is a federation consisting of ten Provinces and two northern territories. The Nation's Constitution, the British North America Act, gives each Province jurisdiction over the natural resources within its boundaries. The production and distribution of electricity and other forms of energy are therefore controlled by the various provincial governments."¹ The United States, on the other hand, is a federation of fifty states and its natural resources fall under both state and federal jurisdiction.

During the past seventy years, legislation passed by the Canadian and United States governments has also shaped the development of international interconnections. In 1907, the Canadian Parliament passed the "Electricity and Fluids Exportation Act" in response to public concern over the transfer of the nation's hydro-electric resources by contract to the United States. This act established federal jurisdiction over exports of electricity. It also required that any person or group wishing to export electric power from Canada must first obtain a license. A duty of 0.3 mills* per kilowatt hour was later placed on exports and remained in effect from 1925 until 1963. In 1959, Parliament enacted the "National Energy Board Act," which replaced the 1907 Act. The National Energy Board was established to advise the Federal Government on all matters related to energy and to regulate certain aspects of the oil, gas and electric utility business. Jurisdiction over electric energy was limited to the regulation of power lines crossing the international border and the licensing of exports of energy from Canada. All other aspects of the supply and distribution of electricity remained under provincial control.¹

In the United States, the Federal Power Act (enacted in 1935), established the Federal Power Commission, which was given a regulatory role in the interstate transmission and wholesale marketing of electric power. This Act prohibited the exportation of energy from the United States to a foreign country without federal authorization. Any person wishing to export energy was first required to submit an application and, if necessary, attend a hearing before a federal licensing authority. Currently, the Economic Regulatory Administration of the Department of Energy exercises the regulatory mandates.

* A mill is a thousandth part of a dollar.

Increasing concerns for the environment during the 1960's in the United States led to the enactment of the National Environmental Protection Act and the formation of the Environmental Protection Agency. The Act requires the preparation and distribution of an environmental statement in connection with any major federal action significantly affecting the quality of the human environment, including thorough evaluation of alternative courses of action.

Canada has also established several federal and provincial environmental agencies during the past decade to minimize adverse impacts associated with the growth and expansion of the electric utility industry. The objectives of these environmental control agencies are to ensure that supply of electrical energy is made available with careful regard for the environment. Federal projects, or those that receive federal financial assistance or utilize federal lands are reviewed by an environmental assessment panel appointed by Environment Canada.³ Specific legislation which has affected international electric energy planning and implementation of projects between the two countries is detailed later in this report.

In 1961, the Columbia River Treaty was signed by the United States and Canada, providing for joint hydroelectric development of the Columbia River. Under the Treaty, Canada has built three large storage dams which store more than 15.5 million acre-feet of water. This storage capacity levels out the flow of the Columbia River and enables the United States dams (downstream) to generate up to 2.8 million kilowatts of additional electricity. Each country is entitled to half of the additional power made usable by this storage. Under this Treaty the United States also built Libby Dam in Montana. The dam's reservoir extends 42 miles into Canada and offers an additional 5 million acre-feet of storage, adding approximately 1 million kilowatts of firm power at site and downstream. This brings

the total Treaty power benefits to 3.5 million kilowatts. Another important benefit of the Columbia River Treaty is flood control. The projects developed under this Treaty have ended the threat of major floods on the Columbia and Kootenai Rivers.

The capability of international interconnections to mitigate impacts associated with emergencies which arise in either country was recently realized during the 1977 water shortage in Manitoba and the 1978 coal strike in the United States in which the country not directly affected was able to assist by providing additional supplies of electricity. Under adverse conditions, the performance of the bulk-power systems within the affected region, and in the adjacent regions which provided substantial help, demonstrated the contribution of international power lines in providing reliable electric service to consumers.

ORGANIZATIONAL STRUCTURE

There are both similarities and significant differences between the electric energy supply systems in the United States and Canada. These similarities and differences extend from types of ownership, organizational structures, operating procedures, and regulatory concepts. Even though there are differences, there is extensive cooperation between Canadian and United States utilities.

The Regional Electric Reliability Councils, although predominantly United States organizations, include four Provincial Canadian electric utilities as active members. The Regional Councils are members of the National Electric Reliability Council as shown in Figure 2-2. A special provision of the NERC bylaws provides for a representative of the Canadian National Energy Board to participate in NERC activities as an observer. The United States Department of Energy is afforded a similar privilege.

FIGURE 2-2

Regional Electric Reliability Councils

ECAR East Central Area Reliability Coordination Agreement		MAIN Mid-America Interpool Network		SERC Southeastern Electric Reliability Council
ERCOT Electric Reliability Council of Texas		MARCA Mid-Continent Area Reliability Coordination Agreement		SPP Southwest Power Pool
MAAC Mid-Atlantic Area Coordination Group		NPCC Northeast Power Coordinating Council		WSCC Western Systems Coordinating Council

The North American Power Systems Interconnection Committee (NAPSIC) is an organization of both Canadian and United States electric utilities. This committee establishes operating guides that are applicable to electric utilities in both nations. These operating guides provide the basis for the coordinated operation of all bulk electric energy supply systems in the two countries.

In Canada all major electric energy systems, except in Alberta, are provincially owned. This ownership pattern contrasts with that of the United States, where most major electric utilities are investor-owned. The provincial ownership causes Canadian utilities to directly reflect the policies of their provincial government, whereas the investor-owned United States utilities must first reflect corporate policies, which will normally have some foundation in both state and national policies. The two privately owned electric utilities in Alberta have no transmission system interconnections to United States utilities.

Federal regulatory influence on electric utility operations is significantly greater in the United States than in Canada. This influence can be seen through federal regulation of all interstate electric energy transactions and through federal environmental control policies and agencies. In Canada both of these activities are almost entirely within the domain of the provincial governments. Regulatory control over the export of electric energy from both countries is, however, the responsibility of the respective federal governments. Neither federal government exercises any control over the imports of the electric energy from foreign countries, although the Canadian National Energy Board considers imports when evaluating export applications.

Electric utilities in the contiguous 48 states of the United States

have organized three major grid systems, and nearly all utilities operate on an interconnected and synchronous basis with one of these grids. Two of these grid systems have direct interfaces with Canada. One grid covers the area east of the Rocky Mountains and includes the electric utilities in the Canadian Provinces of New Brunswick, Ontario, Manitoba and Saskatchewan. Another grid system includes electric utilities located west of the Rocky Mountains and those utilities located in the Canadian Provinces of British Columbia and Alberta. Electric utilities in the Canadian Provinces of Quebec and Newfoundland and in the States of Texas and Alaska are isolated from these grids. Quebec and Texas utilities are operationally isolated for technical reasons while the Newfoundland and Alaskan utilities are isolated due to geography.

Recently the eastern and western grids in the United States were connected through a direct current line in Nebraska that has a very limited capacity. No such east-west transmission lines exist in Canada between electric utilities in Saskatchewan and Alberta. Electric energy interchanges between United States electric utilities and Quebec or between Quebec and other Canadian provinces require special arrangements such that the generation is separated from its normal transmission connections and connected to the load system. A direct current asynchronous interconnection can be utilized to overcome this requirement. At present, the only such connection is between the electric utilities in Quebec and New Brunswick. The current New York-Quebec electricity interchange requires that the supplying system isolate certain generators from its grid and operate them as part of the receiving system.

Alaska does not have an existing or planned statewide transmission system. Fairly extensive generation and transmission systems are developing in the vicinities of Anchorage and Fairbanks, which are

the two largest power markets in the State. Interconnection between Anchorage and Fairbanks is likely within the next 10 to 15 years. The other smaller power market areas in Alaska are served independently. Individual utilities provide over 90 percent of Alaska's power supplies, with about 9 percent provided by two Federal hydro-electric projects. The Northern Canada Power Commission, which provides power in the Yukon Territory, operates a sizeable 138 kilovolt transmission system connecting the major loads in the territory. Power sources are hydro and oil.

EXISTING TRANSMISSION INTERCONNECTIONS

The transmission lines between Canada and the United States provide over 8,000 megawatts of installed transmission capacity between the two nations. Approximately one-fourth of this capacity exists in the Western Region and three-fourths in the Eastern Region. Table 2-1 lists all existing transmission lines between Canada and the United States at voltages of 69 kilovolts and higher. The capabilities as shown in the table are nominal ratings. In actual operation of a power system, these transfer capabilities will vary, depending on system operating status. In general, the transfer capability of a Canadian Province's interties with the United States is greater than the capability of its ties with neighboring Provinces. Figure 1-2 (page 6) shows the transfer capabilities between various provinces of Canada and the United States. Figures 2-3, 2-4, 2-5 and 2-6 show the approximate geographical location of the important transmission lines.

In addition to the transmission lines listed in Table 2-1, there are a number of lower voltage distribution lines crossing the border. These lines cannot be considered interconnections, since they primarily supply electricity at customer utilization voltage to specific customers.

TABLE 2-1

**EXISTING ELECTRIC POWER TRANSMISSION LINES, 69 KV AND ABOVE
BETWEEN THE UNITED STATES AND CANADA**

CANADIAN PROVINCE	CANADIAN TERMINAL LOCATION	U.S. STATE	UNITED STATES TERMINAL LOCATION	VOLTAGE (kV)	POWER TRANSFER CAPABILITY* (MW)
New Brunswick	Beechwood	Maine	Flo's Inn	69	35
	Grand Falls		Fraser	69	85
	Edmundston		Caribou	69	85
	Tinker		Caribou	69	50
	Tinker		Flo's Inn	69	35
	Keswick		Orrington	345	500
Quebec	Chateauguay	New York	Massena	765	1,200
	Cedar Rapids		Massena	120	100
	Cedar Rapids		Massena	120	100
Quebec	Stanstead	Vermont	Highgate	120	100
Ontario **	Beck	New York	Optap Terminal	69	75 (Idle)
	Beck		Garderville	69	75 (Idle)
	Beck		Packard	230	470
	Beck		Niagara Falls	230	400
	Beck		Tonawanda	69	75 (25 Hz)
	Beck		Tonawanda	69	40 (25 Hz)
	St. Lawrence		Moses	230	300
	St. Lawrence		Moses	230	300
Ontario **	Sarnia-Scott	Michigan	Bunce Creek	230	535
	J.C. Keith		Waterman	230	515
	Lambton		St. Clair	345	710
	Lambton		St. Clair	345	760
Ontario	Fort Frances	Minnesota	International Falls	120	35
Manitoba	Laverendrye	North Dakota	Grand Forks	230	150
Manitoba	Ridgeway	Minnesota	Warroad	230	175
British Columbia	Waneta	Washington	Boundary	230	350
	Nelway		Boundary	230	300
	Ingledow		Custer	500	700
	Ingledow		Custer	500	700

* As provided by regions in their reports and defined by NERC as the total amount of power (above the net contracted purchases and sales) which can be scheduled, with an assurance of adequate system reliability, for interregional or multi-regional transfers over the transmission network for periods up to several days, based on the most limiting criterion.

** Installed interconnection capacity; simultaneous transfer capabilities can be considerably less, see Chart 1-3, Appendix D (page 42).

FIGURE 2-3

EXISTING TRANSMISSION
INTERCONNECTIONS

QUEBEC-LABRADOR AND
NEW ENGLAND/MARITIMES REGION

FIGURE 2-4

EXISTING TRANSMISSION
INTERCONNECTIONS

QUEBEC-LABRADOR AND
ONTARIO-NEW YORK/ECAR
REGION

MANITOBA

FIGURE 2-5

EXISTING TRANSMISSION
INTERCONNECTIONS

MANITOBA/MARCA REGION

ONTARIO

230 kV

230 kV

120 kV

NORTH
DAKOTA

MINNESOTA

SOUTH
DAKOTA

WISCO

IOWA

NEBRASKA

FIGURE 2-6

EXISTING TRANSMISSION
INTERCONNECTIONS

WESTERN REGION

ALBERTA

Western Region

It should be pointed out that the Canadian share of each transmission interconnection listed under the Province of Ontario is owned by Ontario Hydro except the 120 kilovolt transmission line from Fort Francis to International Falls. This line is owned by the Ontario - Minnesota Pulp and Paper Company (Boise Cascade) and is exclusively used for the transfer of power from its generating plant in Fort Francis, Ontario to its wood pulp plant in International Falls, Minnesota.

LOAD AND RESOURCE FORECASTS

This section examines the peak load forecasts and the resource plans of United States and Canadian utilities. The forecasts of peak loads for the NERC regions for the 1978-1987 period, and the planned resources to meet these loads, are given in Tables 2-2 and 2-3.* Comparison of these numbers shows (Table 2-4) that United States reserve margins are higher in winter and Canadian reserves are greater in summer. Seasonal diversity is a characteristic now partially exploited in international electricity interchange; it is expected to become more important as the difference between summer and winter reserve margins of the two countries increases.

Some areas in the United States are now winter peaking (e.g., Northwest), and the entire United States NPCC region is expected to become winter peaking after 1981. However, the general pattern of winter power transfers to Canada and summer transfers to the United

* Only the loads and resources of the members of NERC are included. For Canada, these are the Provinces of New Brunswick, Ontario, Manitoba, and British Columbia. The other provinces are not NERC members and so are not included in Tables 2-2 to 2-4.

TABLE 2-2

PLANNED RESOURCES: GENERATING CAPACITY (MW)¹

Year	NPCC-ECAR REGION ²				MARCA REGION ²				WSCC REGION ²			
	UNITED STATES		CANADA		UNITED STATES		CANADA (Manitoba only)		UNITED STATES		CANADA (British Columbia only)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1977	129,030				21,223				89,228			
1978	135,245	140,390	23,021	24,366	22,845	24,333	3,147	3,505	94,617	97,726	8,033	8,105
1979	140,609	144,377	24,803	25,314	24,313	25,574	3,730	3,868	102,109	103,751	8,105	8,455
1980	143,651	151,350	25,042	25,982	26,004	26,611	3,328	4,168	106,877	107,595	9,255	9,605
1981	150,143	156,766	26,149	27,716	28,086	28,293	3,378	4,218	110,634	112,544	9,605	9,605
1982	155,768	163,709	27,790	28,909	28,568	28,565	3,528	4,368	115,673	115,844	9,605	9,605
1983	164,723	171,509	30,153	31,476	29,979	30,184	3,528	4,368	120,921	122,130	9,605	10,955
1984	169,752	179,496	31,837	32,484	30,896	31,374	3,645	4,719	126,803	128,529	11,405	11,405
1985	179,924	186,014	32,749	35,179	32,588	32,437	4,230	5,187	131,638	135,385	11,405	11,905
1986	186,074	193,522	35,503	36,269	32,736	32,560	4,581	5,538	139,691	141,829	11,905	12,405
1987	193,963	200,075	37,109	37,635	34,028	34,210	4,698	5,538	144,408	145,556	12,405	12,405

¹Source is NERC, 1978; 8th Annual Review. (Reference 5). These resource data include scheduled purchases/sales (net) and generating capacity existing, presently under construction, and that which is in various stages of planning. The completion of this capacity is subject to the timely receipt of appropriate approvals of permits and licenses and the continued financial capability of the systems.

²For geographic location of regions refer to Figure 2-2 (pg. 21).

TABLE 2-3

FORECAST OF DEMAND: PEAK LOADS (MW)¹

Year	NPCC-ECAR REGION ²				MARCA REGION ²				WSCC REGION ²			
	UNITED STATES		CANADA		UNITED STATES		CANADA (Manitoba only)		UNITED STATES		CANADA (British Columbia only)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1977 Actual	97,444	95,652	13,017	16,235	17,300	15,811	1,553	2,405	64,286	60,979	3,732	4,953
1978	101,118	100,743	14,308	18,055	18,458	16,677	1,861	2,541	71,282	69,273	3,937	5,621
1979	105,770	105,858	15,175	19,252	19,608	17,739	1,972	2,707	75,505	72,798	4,343	5,994
1980	111,275	111,271	16,189	20,545	20,749	18,868	2,079	2,899	79,178	76,703	4,648	6,460
1981	116,516	116,818	17,295	21,959	22,050	19,984	2,213	3,113	83,277	80,580	4,923	6,888
1982	121,904	122,470	18,450	23,413	23,307	21,082	2,363	3,343	87,438	84,067	5,393	7,571
1983	127,355	128,565	19,645	24,917	24,614	22,381	2,492	3,589	90,739	87,573	5,784	8,074
1984	133,186	134,942	20,904	26,512	25,984	23,787	2,699	3,851	94,750	92,170	6,166	8,623
1985	139,455	141,682	22,258	28,233	27,435	25,178	2,870	4,135	99,418	96,158	6,541	9,177
1986	145,920	148,831	23,713	30,079	28,928	26,658	3,063	4,438	103,764	100,340	6,980	9,821
1987	152,591	156,159	25,255	32,024	30,294	28,156	3,284	4,763	108,151	105,074	7,449	10,520

¹Source is NERC, 1978; 8th Annual Review. (Reference 5).

²For geographic location of regions refer to Figure 2-2 (pg. 21).

TABLE 2-4a

PROJECTED RESERVE MARGINS (MW)¹

Year	NPCC-ECAR REGION ²				MARCA REGION ²				WSCC REGION ²			
	UNITED STATES		CANADA		UNITED STATES		CANADA (Manitoba only)		UNITED STATES		CANADA (British Columbia only)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1977	31,586				3,923				24,942			
1978	34,127	39,647	8,713	6,311	4,387	7,656	1,286	964	23,335	28,453	4,096	2,484
1979	34,839	38,519	9,628	6,062	4,705	7,835	1,758	1,161	26,604	30,953	3,762	2,461
1980	32,376	40,079	8,853	5,437	5,255	7,743	1,249	1,269	27,699	30,892	4,607	3,145
1981	33,627	39,948	8,854	5,757	6,036	8,309	1,165	1,105	27,357	31,964	4,682	2,717
1982	33,864	41,239	9,340	5,496	5,261	7,483	1,165	1,025	28,235	31,777	4,212	2,034
1983	37,368	42,944	10,508	6,559	5,365	7,803	1,036	779	30,182	34,557	3,821	2,881
1984	36,566	44,554	10,933	5,972	4,912	7,587	946	868	32,053	36,359	5,239	2,782
1985	40,469	44,332	10,491	6,946	5,153	7,259	1,360	1,052	32,220	39,227	4,864	2,728
1986	40,154	44,691	11,790	6,190	3,808	5,902	1,518	1,100	35,927	41,489	4,925	2,584
1987	41,372	43,916	11,854	5,611	3,734	6,054	1,414	775	36,257	40,482	4,956	1,885

¹Source is NERC, 1978; 8th Annual Review. (Reference 5).

²For geographic location of regions refer to Figure 2-2 (pg. 21).

TABLE 2-4b
PROJECTED RESERVE MARGINS (%)¹

Year	NPCC-ECAR REGION ²				MARCA REGION ²				WSCC REGION ²			
	UNITED STATES		CANADA		UNITED STATES		CANADA (Manitoba only)		UNITED STATES		CANADA (British Columbia only)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1977	32				23				39			
1978	34	39	61	35	24	46	69	38	33	41	104	44
1979	33	36	63	31	24	44	89	43	35	43	87	41
1980	29	36	55	26	25	41	60	44	35	40	99	49
1981	29	34	51	26	27	42	53	35	33	40	95	39
1982	28	34	51	23	23	35	49	31	32	38	78	27
1983	29	33	53	26	22	35	42	22	33	39	66	36
1984	27	33	52	23	19	32	35	23	34	39	85	32
1985	29	31	47	29	19	29	47	25	32	41	74	30
1986	28	30	50	21	13	22	50	25	35	41	71	26
1987	27	28	47	18	12	22	43	16	34	39	67	18

¹Source is NERC, 1978; 8th Annual Review. (Reference 5).

²For geographic location of regions refer to Figure 2-2 (pg. 21).

States is expected to continue. This is because reserve margins in the United States, even in the NPCC region, will remain higher in winter than in summer. The lower temperatures in winter allow thermal generating units to operate at greater capacity than in the summer. Also, the United States as a whole will remain summer peaking. This continued diversity in reserves and loads can be the basis for reserve sharing and seasonal electricity exchange agreements.

All forecasted⁵ regional reserve margins in Table 2-4 are 15% or greater. However, the actual reserve margins in the future may differ, due to: (1) slippages in new generating unit commission dates due to difficulties in financing; (2) delays in receipt of required regulatory approvals for new construction; (3) the occurrence of loads at variance with the forecasts. One has only to examine the on-going licensing battles in the courts, the plethora of public hearings, and the recent record of construction delays and permit denials to conclude that the utility industry's ability to meet its planned resource levels is not assured. As to the accuracy of load forecasts,* Table 2-5 compares the actual regional 1978 summer peak loads and growth rates with the forecasts issued in the spring of 1978. It is evident that forecasts are not easy in the light of uncertain (but rising) energy costs, economic trends, and changes in end use efficiencies.

Figure 2-7 compares the present primary fuel sources for generation of electricity in the border United States - Canadian regions. (The percentages of each fuel type are approximate.) The Northeast United States (NPCC) is heavily dependent on oil and natural gas,

* It was agreed that NERC forecasts would be used in this study. Such forecasts are not official United States Department of Energy or Canadian National Energy Board estimates.

**Table 2-5: COMPARISON OF REGIONAL FORECASTS WITH
ACTUAL 1978 SUMMER PEAK LOADS***

<u>Region</u>	<u>Projected 1978 Summer Peak (MW)</u>	<u>Actual 1978 Summer Peak (MW)</u>	<u>Forecasted 1977-1978 Peak Load Increase (%)</u>	<u>Actual 1977-1978 Peak Load Increase (%)</u>
ECAR	65,433	61,940	6.0	(0.6)
ERCOT	28,277	28,713	7.9	7.1
MAAC	32,713	31,823	1.3	(1.5)
MAIN	34,937	33,265	4.8	(0.4)
MARCA (U.S.)	18,458	17,681	6.7	1.1
NPCC (U.S.)	35,685	35,092	(1.0)	0.7
SERC	84,300	81,977	6.4	3.3
SPP	38,946	39,191	5.7	6.4
WSCC (U.S.)	71,282	68,768	10.8	5.9
MARCA (Canada) (Manitoba)	1,861	1,550	19.8	(0.2)
NPCC (Canada) (Ontario- New Brunswick)	14,308	13,630	10.1	2.2
WSCC (Canada) (British Columbia)	<u>3,937</u>	<u>4,013</u>	<u>7.0</u>	<u>7.5</u>
TOTALS	430,137	417,652	6.1	3.0

***Source: National Electric Reliability Council**

FIGURE 2-7

Present Sources of Fuel for Electricity Generation

(APPROXIMATE PERCENTAGES
IN TERMS OF KWH GENERATED)

while the neighboring regions of Canada have substantial hydro resources. British Columbia and the Western United States exhibit similar characteristics, although not to as marked a degree as the East. The central United States has much coal-fired generation. Central Canada is also heavily coal-fired, but it has more hydro-electric generation than the corresponding regions in the United States.

These diversities, in seasonal peak and in generation mix, offer opportunities for electricity exchange which could benefit both countries. The nature, magnitude, and potential benefits of such exchanges can be estimated, and the regional reliability councils and provincial utilities addressed themselves to those questions in this study. (See Appendix D.) While estimates of potential benefits can be made, underlying all is the acknowledgement that the uncertainties inherent in both demand and supply forecasts may make those potential benefits more or less than predicted.

FUTURE PLANS FOR TRANSMISSION INTERCONNECTIONS BETWEEN THE UNITED STATES AND CANADA

Historically, one important reason for building power lines between Canada and the United States has been to sell surplus energy. As time has progressed, the number of transmission interconnections between the two countries has significantly increased. These lines were built, not only for the export of surplus energy, but also to provide the means for utilities on each side of the border to provide support to their neighbors in times of emergency and to take advantage of the other important benefits which accrue from interconnections.

Several high voltage transmission interconnections between Canada and the United States are in various stages of planning, commitment

or construction. A description of major committed or planned interconnections between the two countries is presented below. This description is summarized in Table 2-6. Figure 2-8 demonstrates the future transfer capability, as planned, between the two countries.

1. New Brunswick - Maine

The Maritimes/New England region plans to upgrade the 69 kilovolt line between Flo's Inn, Maine and Beechwood, New Brunswick to 138 kilovolts in 1979. This upgrading will increase the transfer capability between the two areas by about 40 megawatts. (Figure 2-9)

2. Ontario - New York

The two existing interconnections between Ontario and New York, crossing the borders at Niagara, are planned to be modified as follows:

- Convert an idle circuit to 345 kilovolts in 1981.
- Convert a 69 kilovolt, 25 Hertz line to 345 kilovolts and 60 Hertz in 1983.

The two changes will increase the transfer capability between these two areas by approximately 1,800 megawatts. (Figure 2-10)

3. Ontario - Michigan

Several technical and economic studies are being conducted by the electric utilities of these two areas to assess the feasibility of increased power transfer capabilities. As a result of some of these studies, it has been determined that some internal transmission line additions will be necessary on the

TABLE 2-6

**FUTURE PLANS FOR ADDITIONAL OR UPGRADED
INTERCONNECTED TRANSMISSION LINES**

Canadian Province	U.S. State	Planned for	Voltage (kV)	Estimated Power Transfer Capability (MW)
New Brunswick	Maine	1979*	138	75
Manitoba	Minnesota	1980	500	1,000
Ontario**	New York	1981	345	1,150
Saskatchewan	North Dakota	1981	230	200
Ontario**	New York	1983	345	1,150
Manitoba	Nebraska/ Dakotas	1985	+450 DC/ 500 AC	1,000-1,500

* Existing 69 kV line between Beechwood and Flo's Inn will be converted to 138 kV.

**Simultaneous transfer capability is approximately 1800 MW.

FIGURE 2-8

**PLANNED ADDITIONAL OR UPGRADED TRANSMISSION INTERCONNECTIONS—69 kV AND ABOVE
GEOGRAPHICAL DISTRIBUTION**

*Estimated Summer Transfer Capability.

FIGURE 2-9

PLANNED ADDITIONAL OR UPGRADED
TRANSMISSION INTERCONNECTIONS

QUEBEC-LABRADOR AND
NEW ENGLAND/MARITIMES REGION

FIGURE 2-10

**PLANNED ADDITIONAL OR UPGRADED
TRANSMISSION INTERCONNECTIONS**

**QUEBEC-LABRADOR AND
ONTARIO-NEW YORK/ECAR
REGION**

Ontario hydro system if the power transfer capability is increased. At this time, no firm plans exist for additional transmission interconnections between Ontario and Michigan.

4. Ontario - Minnesota

No future plans for additional transmission interconnection between these two areas exist at this time. The possibility, however, for developing interconnections at a later time does exist.

5. Manitoba - Minnesota/Dakotas/Nebraska

Opportunities for increased transfer capabilities and the possibility of significantly more Canadian - United States transactions exists in these areas. Commitments subject to regulatory approval have already been made to build the following two interconnections:

- Construct a 500 kilovolt line from Manitoba to Minnesota in 1980. This tie line will add 1,000 megawatts of transfer capability between the two areas. Canadian approvals have been received and the United States regulatory process is nearing completion.
- Construct a ± 450 kilovolt direct current line or 500 kilovolt alternating current line from Manitoba through the Dakotas to Nebraska in 1985. This line will increase the transfer capability by a total of 1000-1500 megawatts. (Figure 2-11)

6. Saskatchewan - North Dakota

A commitment by the utilities has already been made to construct a 230 kilovolt line between these areas by 1981. After the line has been built a transfer capability of about 200 mega-

SASKATCHEWAN

MANITOBA

FIGURE 2-11

**PLANNED ADDITIONAL OR UPGRADED
TRANSMISSION INTERCONNECTIONS**

MANITOBA/MARCA REGION

watts will exist between these two areas. There is no interconnection at present. (Figure 2-11)

7. Alberta/British Columbia - Montana/Washington

At the present time, no firm or tentative plans for additional transmission interconnections between these areas exist. Further, it is possible that construction of certain large thermal power plants in the Pacific Northwest of the United States could reduce Bonneville Power Administration (BPA) power transfer capability from north to south by about 500 megawatts. Increased internal transmission line usage by the British Columbia Hydro system limits the future possibilities of transmission interconnections even further, unless the system is specifically designed for exporting power.

TYPES OF TRANSACTIONS

The types of electric power/energy transactions which take place between electric utilities vary according to the short-and long-term needs of the purchaser of power or energy, the availability of power or energy from a prospective supplier, the relative amount of transmission interconnections between the systems, and the geographical locations of the supplier and receiver. Electricity transactions among utilities may be paid for as a cash payment at an established price or by an agreement to return equal amounts of electricity during a later, mutually agreed-upon period. It is possible that the service areas of the two parties to the transaction will not be contiguous, thereby creating a geographical constraint. In this situation one or more intermediate utilities must transport (wheel) the electricity through its system, receiving an appropriate payment for this service.

Utilities enter into legal agreements, usually known as interconnection or pooling agreements, which include the definitions of the various classes of power/energy to be exchanged or sold. Rate schedules specifying terms covering the charges for the various classes of power/energy are usually appended to the agreement. Most schedules contain basic cost data and provide for the involved system operators to ascertain the actual energy costs using incremental system data. Firm transactions normally include a fixed charge (demand) component that provides some recovery for the invested capital. Diversity exchanges will usually require a return of an equal amount of electricity at a different time.

Terminology for the various types of electric power/energy exchanges varies widely both between utilities in Canada and the United States and among the utilities within each country. The conditions of sale or exchange vary significantly according to whether a utility is primarily a thermal system, using fossil (or nuclear) fuels, or a hydro system, mainly using water power to generate electricity.

In Canada and the United States the major types of power/energy transactions as reported by the regions are:

- Firm: Available power (capacity) and/or energy that has the characteristic such that the supplier is obligated to deliver capacity or energy as scheduled for an extended period, unless delivery will likely result in the curtailment of the electricity supply to consumers in his own system.
- Non-Firm: Power (capacity) and/or energy available from surplus generating resources which is interruptable on very short notice.

- Short-Term: Power (capacity) and/or energy that has the characteristics of firm except that the period of this transaction is for a specified period. Normally, a weekly reservation period is required. Separate capacity and energy charges are usually applicable.
- Unit Power: Power (capacity) and/or energy available from a specific generating unit or power plant for an extended period, with availability normally dependent on the performance of the designated generator unit or plant.
- Seasonal Diversity Exchange: Power (capacity) and/or energy exchanged between utilities with annual peak loads in different seasons (summer versus winter). Supplier is obligated to deliver capacity and energy as scheduled unless delivery will jeopardize the supply to his own customers.
- Off-Peak Energy: Energy provided normally during off-peak periods for one or more weeks to supplement or conserve fuel storages (fossil or hydro) of the receiving system. Such deliveries are normally considered non-firm.
- Emergency: Power (capacity) and/or energy provided on an hourly or daily basis to supplement the generating capability of the receiving system during periods of temporary capacity deficiencies. Normally hour by hour negotiations are required, and a receiving system must make other arrangements within an hour after notice that the emergency delivery will be curtailed. Charges are typically the incremental cost of the supplying system plus a percentage adder.

- Economy Energy: Energy delivered on an hourly basis to effect fuel and other operating savings when the receiving party has adequate generation. Delivery is not firm, and may be terminated by either seller or buyer with as little as 30 minutes notice. Any savings achieved are normally shared by the two parties.
- Operating Reserve/Spinning Reserve: Excess generating capacity held available on ten minutes or less notice by a system for use by another system in satisfying its operating reserve requirements. A capacity charge will be made.
- Treaty Deliveries: Deliveries of energy required or permitted by treaty (such as the Columbia River Treaty). Both monetary and energy return may be utilized to cover any costs.
- Transmission Service (Wheeling): Energy transported by an intervening party between a supplier and a receiver. Arrangements must be made such that a reliability problem does not occur on the transporting utility. Compensation will usually include the costs of any losses plus an additional charge based on transmission investment.
- Storage Transfer: An electric energy transfer "banked" for the time being in the form of water in reservoir space of another electrical utility, in the expectation that equivalent electric energy will be returned at a later time.
- Adjustment Transfer: An electric power/energy transfer to adjust electric power/energy account balances, to compen-

state for services rendered, to deliver output entitlements, or to deliver upstream or downstream benefits.

AUTHORIZATION PROCEDURES

1. United States - Federal and State

The electric power industry is one of the most highly regulated activities in the United States. Since the beginning, the trend toward increased regulation by local, state and federal government authorities has continued. In this section, a discussion of this regulation and how it has affected international bulk power transactions with Canada will be given.

Federal regulation of international exchanges of electricity had its origins in the Federal Power Act which was enacted by Congress in 1935. The Federal Water Power Act of 1920 was made Part I of the Federal Power Act. Part II established the Federal Power Commission's jurisdiction over interstate transmission of electric energy and non-federal and non-state owned public utilities involved therein. Part III relates to administrative and procedural provisions of the Act. Section 202(e)* of Part II concerns the exportation of electric energy to foreign countries. The legislation states that no "person shall transmit any electric energy from the United States to a foreign country without first having secured an order of the Commission [FPC] authorizing it to do so." The Commission, upon receiving an application for exportation, could issue such an authorizing order unless the proposed transmission would threaten the "sufficiency of electric supply within the United

* See Appendix C.

States or would impede or tend to impede the coordination of facilities subject to its jurisdiction." Section 202(f) was added to the Federal Power Act in 1953. This section prohibited the Commission from exercising regulatory jurisdiction in other matters, even though Section 202(e) of the Act was applicable. Also added was a provision providing that a state may impose regulatory controls and policies over international exports provided that they do not conflict with the exercise of the federal regulatory powers.

In July 1939, President Roosevelt issued Executive Order 8202 which established a requirement for the issuance of a permit by the President for electric transmission lines crossing international borders. President Eisenhower, in September 1953, issued Executive Order 10485 which transferred from his office the authority to receive applications for international transactions and issue such orders and permits to the Federal Power Commission and/or Chairman. Recently, President Carter issued Executive Order 12038 which delegated these same authorities to the Secretary of Energy. The purpose of the original order was to provide a "systematic method in connection with the issuance and signing of permits for the construction and maintenance (at the borders of the United States) of facilities for the exportation or importation of electric energy and natural gas."

The Secretary of Energy is currently authorized to issue presidential permits for the construction, operation, maintenance or connection (at the borders of the United States), of facilities for the transmission of electric energy between the United States and a foreign country. The Secretary of Energy has now delegated this authority to the Administrator of the Economic Regulatory Administration (Delegation Order 0204-4).

In addition to the authorization procedure described above, it is also necessary to submit an environmental impact statement in accordance with the National Environmental Protection Act, which was passed in 1969. Other federal requirements regarding wet lands, flood plains, critical wildlife habitats and waterway crossings may be required, depending on line routes.

In conclusion, while there is no time limit for the issuing of federal licenses, the combined Presidential Permit and environmental impact statement authorization process will require between eighteen and twenty-four months. No finite term is required by the statute for any permit or export authorization. All Presidential Permits and electricity export authorizations include a clause permitting the federal licensing authority to void the permit or cancel the export authorization. No such action has ever been taken.

2. Canadian Authorization Procedures*

A Canadian utility seeking to export electricity to the United States must obtain a certificate of public convenience and necessity for an international power and export license. Both are issued by the National Energy Board (NEB) following a public hearing. The applicant must demonstrate that the power and/or energy to be exported is surplus to Canadian requirements and that the price is just and reasonable in the public interest. While neighboring provinces are given the right of first refusal, they must match the export price.

* More detail on federal and provincial regulatory requirements will be found in Appendix C.

Electrical energy export licenses and certificates must be approved by the federal Cabinet. This and the hearing are waived for authorization of less than 4 MW or 20 GWh per year or in emergencies. The National Energy Board Act limits the terms of licenses to 25 years. Most are issued for 5 to 10 years. The Board also considers economic impact, employment opportunities, balance of payments and environmental impact.

Financial feasibility must also be demonstrated. Since July 1974, the National Energy Board has required every utility applying for a certificate to provide an assessment of environmental impact. Environmental jurisdiction in Canada generally is provincial. A Cabinet ruling requires any federal department responsible for helping to finance a project or to initiate a project, or responsible for federal property involved in a project, to request an environmental review by the Department of Fisheries and Environment if a screening reveals that significant adverse environmental effects may result. In most cases, both the province and the department responsible for a federal project can be expected to depend on the National Energy Board for environmental assessment of export transmission facilities. In any case, it is very unlikely that an export transmission line would be initiated or financed by a federal department or involve federal property.

Where a transmission line crosses a navigable body of water, the crossing must comply with the Navigable Waters Act. This requires separate authorization from the Department of Transport. The Fisheries Act must also be complied with.

The exporting utility must obtain a letter from the International Boundary Commission which then discusses plans with the U.S. Commissioner and issues a joint approval.

Experience has demonstrated that parties contemplating export benefit from prior consultation with the National Energy Board. These consultations ensure fuller understanding by utilities of National Energy Board regulatory policies and procedures and enable complete applications to be prepared with minimum delay.

The National Energy Board has developed three criteria that the export price must meet. It must be not less than the cost of the energy to be exported, it must be not less than the cost of comparable service to Canadians, and it should, in normal circumstances, not be materially less than the least cost alternative available to the United States purchaser. In certain cases, including those where the United States purchaser participates financially in transmission or generation facilities, the third criterion takes account of the transmission cost to deliver energy to the market area.

For economy interchanges the board accepts a price intermediate between the cost of generation in Canada and the least cost alternative. This is the generally-accepted formula for economy energy sales under interconnection agreements.

The National Energy Board license may set maximum limits as to annual quantities. Minimum prices or pricing formulae are prescribed, but the licensee is free to negotiate transactions within these limits, subject to the general conditions of agreements filed at the hearing. All revenues and quantities are reported to the Board. Short term firm sales of power may be subject to price approval when negotiated but this is a simple administrative procedure. Where an electrical export is derived from oil or gas, the electrical export price must reflect the export price of the oil or gas.

Provincial regulation relates to the system apart from the export transmission line. Rates paid by Canadian consumers are entirely a provincial matter. Thus the province influences the export price indirectly via the second test (export price must be not less than the price for comparable service to Canadians). Where fossil thermal generation is involved, fuel cost is influenced by provincial air management procedures. Scrubbers have not been required to date, but ground level concentrations of SO_2 have led to fuel switching orders in some cases, to comply with provincial incident control measures.

3. OPPORTUNITIES AND INCENTIVES FOR INCREASED TRANSACTIONS

Interconnections between electric utility systems have historically proven to be both technically and economically beneficial to all parties involved. Such benefits are present whether or not an interconnection crosses an international border and extend to utilities and customers alike. The technical benefits obtained include improved system reliability and more flexible response to system emergencies. Therefore, additional interconnections and increased transactions between the utilities of the United States and Canada offer economic and social benefits to the utilities and citizens of both nations.

There is considerable potential for increased international electricity transactions. In some regions, new transmission facilities will be required, while, in other locations, the more effective use of existing transmission lines should be considered. A regional approach is believed necessary if opportunities are to be optimally identified.

GENERAL BENEFITS OF INCREASED INTERNATIONAL TRANSACTIONS

The benefits which are associated with increased electric energy exchanges are described below. The greater the benefits to be derived from a transaction, the stronger the incentive for that transaction.

- Reliability and Reserve Sharing:

Contractual agreements for mutual emergency support between utilities can be used either to improve total system reliability or to reduce the operating reserve margin requirement of each activity.

- Load Diversity:

When two electric utility systems in adjoining areas, or relatively close areas, experience their peak loads at different times of the year, the systems can be served with less installed generating capacity when the system loads are combined such that generating resources of both systems are better utilized. This "shared" generation concept causes economic benefits to accrue to both systems.

- Surplus Energy Sales:

Energy which is not needed by a generating system at the time of its availability can be sold to a secondary market (i.e., another utility) or (in the case of hydroelectric energy) stored in another utility's reservoirs. Energy sources which may provide energy greater than current requirements include run-of-river hydro, storage hydro during high water years (when water would otherwise be spilled), and in the future may include solar and wind electric generators, and tidal power. The outputs of these generating systems are controlled by natural factors such that a system may have capacity and energy available in excess of their current load requirements. The ability to make use of this surplus energy will reduce operating costs and conserve fossil fuels.

- Economy Interchange:

Economy interchanges occur where the incremental cost* of one utility is less than the decremental cost** of another utility.

* Incremental cost is the cost (in mills/kWh) of the next available kilowatt hour of generation on the supplying system.

** Decremental cost is the cost of the next available kilowatt hour of generation on the purchasing system.

Larger, more efficient generating units or variations in fuel source can cause the generation costs on one system to decrease while the corresponding costs on another system are higher, therefore, energy can be sold by one utility to another at a cost lower than the purchasing system can generate using its own equipment.

- Unit Power Economies of Scale:

Normally, larger generating units are more cost-effective in operating costs, per kilowatt hour produced, than smaller generating units. However, a particular utility may not be able to install the optimally sized unit because: its load doesn't demand that much capacity; or the costs to the utility of providing adequate operating reserve to cover the contingency of a large unit's failure are prohibitive. In these cases, the utility will not be able to gain optimum economies of scale because it will have to install smaller units. International transactions can provide the opportunity for electric utilities to jointly plan their system expansion and install larger units, thereby accruing economic benefit.

- Coordinated Operations Scheduling:

By coordinating the maintenance schedules of generating units, utilities can ensure that the more efficient generating units are operated a maximum amount of time.

- Use of Complementary Technologies:

Many types of generation technologies complement each other. Historically, cooperation between hydro- and thermal-based systems has been most fruitful. During low water years, the hydro units provide peaking capacity, while the thermal units supply base load energy. In good water years, hydro genera-

tion would normally displace more expensive thermal generation to the extent water resources are available. These characteristics have most notably been exploited in the United States by exchanges between the Pacific Northwest and California (and the Southwest). In Canada, hydro-thermal coordination is the basis for the Manitoba-Saskatchewan and British Columbia-Alberta interconnection agreements.

- Reduced Oil Dependency:

More efficient operations and increased use of coal fired plants and renewable resources, made possible through increased inter-utility electricity exchanges, could reduce the use of oil for generating electricity in both countries. Any reduction in oil dependency will lower the level of foreign imports.

- Local Economy:

Construction of facilities for export purposes, both generation and transmission, will create jobs and increase the tax base in the exporting area. There may be some economic displacement in the importing area, however, the net benefits should be positive for the transaction to be of interest.

PROBLEMS OF INCREASED TRANSACTIONS

The possible benefits previously described may be offset to some extent by related problems which may increase costs.

- Transmission Losses:

As inter-utility transactions increase, the distance electric energy must be transported from generation to load usually increases. As a result, transmission losses will normally increase. Such losses require the installation of additional

generating capacity as well as the increased use of fossil fuel.

- Circulating Power Flows:

Utility facilities in the northern United States are generally more strongly interconnected together than are the transmission facilities between the Canadian provinces. If Canadian-United States interconnections are strengthened, there may be increased power circulating flows between the states. Such circulating flows now occur around Lakes Erie and Ontario. These circulating flows load transmission lines, limiting the transfer capability and can cause increased transmission losses in some areas. However, overall system losses should decrease.

In some locations special system design or equipment such as phase shifting transformers have been installed to reduce circulating flows.

- Transmission Reinforcement:

In order to increase transactions between utilities, additional transmission lines from one utility to the other may be needed. Less obvious, but usually necessary, will be additional intra-system transmission reinforcement which may result in significant costs. It may be difficult to justify the new transmission and interconnection facilities on the basis of uncertain future electric power exchanges.

- Environmental Impacts:

More efficient electric generation should reduce total pollutant emissions, but geographically redistributing the generation also redistributes pollution. Building generation in a "clean" area for export to a more polluted region may use up its "margin" of air quality, and thus hinder development of

additional construction (e.g., it may constrain industrial development). It can be expected that local antipathy will exist toward constructing facilities, with their concomitant land use and air and water quality impacts, dedicated to export.

- System Security:

The interconnecting of two utilities will normally increase their collective reliability. Correspondingly, increase in system size increases the potential for cascading failure, (i.e., there is a larger system to fail). Suitable protective equipment (e.g., to drop loads or to sever interties in an emergency if the system is collapsing) may be needed. Normal operations control and protection schemes (e.g., frequency control, protective relaying) vary from utility to utility. When interconnecting utilities, the control and protective systems of each must be coordinated. For example, two utilities cannot operate together, connected by an alternating current tie, if their dynamic behavior during disturbances is incompatible. However, at a higher cost, an asynchronous tie may be installed eliminating frequency control compatibility problems.

- Balance of Payments:

For international transactions, the effect on both countries' balance of payments must be considered. Also, when computing costs for economy interchange or terms for contracts, the effects of variations in the value of one nation's currency with respect to the others must be considered.

REGIONAL POTENTIAL FOR INCREASED U.S.-CANADA ELECTRICITY TRANSACTIONS

The potential for increased electricity transactions varies widely among the regions. Economic and technical factors vary due to different types of generating equipment and/or fuel requirements. A region-by-region discussion follows.

1. Maritime Provinces - New England Region

Canada's Maritime Provinces (Prince Edward Island, Nova Scotia, New Brunswick) have significant hydroelectric generating capability, but these hydro resources are not divided equally among the provinces. Most of New Brunswick's considerable hydro resources have been developed, while Prince Edward Island is entirely dependent on oil, and Nova Scotia on oil and coal. These Canadian utilities are actively taking advantage of their variations in system characteristics by strengthening transmission interconnections and interchanging more electricity.

The utilities in the New England states operate generators that are predominantly oil-based. Maine and New Brunswick have a long history of interconnection and electricity transactions, (e.g., commitment of 400 MW of Coleson Cove capacity to the Maine market for 10 years). There are some areas in Maine that are electrically isolated from the contiguous United States grids and can only be served by electricity transferred through Canada. The installation of a new 345 kilovolt line between the two in 1970 for the Coleson Cove export strengthened the existing interconnection and resulted

in the synchronous operation of the Maine and New Brunswick systems.

For increased transactions to occur, there must be a need for such transactions and new facilities will be required to achieve them. New England and the Maritime provinces are both projecting surplus capacity in the early 1980's. (This situation depends upon whether New England can complete several nuclear power plants as scheduled.) In both cases, economic considerations cause the surplus capacity to be oil-fired peaking and intermediate range steam generation. The involved Canadian and United States utilities do not anticipate any significant additional sales will be made in the near term between New England and the Maritimes, because there will not be any measurable economic advantage to any party.

Consequently, there are no immediate requirements on the Canadian side for imports of power from the United States, beyond the normal economy exchanges. Similarly, there is only limited opportunity for Canadian exports to the United States until the mid to late 1980's. This situation could change drastically if New England utilities are unable to place several nuclear units in service on schedule. For United States to Canada transfers, an increased amount of interchange could result from closer coordination between the two regions such that greater economies are achieved. New England also has some potential pumped hydro sites which could be used to store energy, and assist in firming up the capacity from a Bay of Fundy tidal project.

For increased Canada to United States transfers in this region, the opportunities relate to projects now underway and

to developments external to the Maritime region. Specific opportunities include:

- Short-term surplus sales during the early years of project service from the Pt. Lepreau nuclear unit now under construction in New Brunswick.

- Early development of large nuclear or coal-fired additions to provide surplus for export.

- Surplus capacity from major developments which might be undertaken in other regions which are interconnected with New Brunswick (e.g., Quebec).

- Surplus peaking capacity from run-of-river hydro plants which are dependent on load growth to develop full peaking capability and thus have early year surpluses of such capacity.

In addition, feasibility studies for some development options for the exploitation of Bay of Fundy tides have shown the need for either:

- Pumped storage hydro facilities (in New England)

- An expanded market (i.e., New England or Quebec)

to absorb the full capacity of the tidal plant when the utility requirements for peak generation does not match the time of peak tidal generation.

Partially offsetting these opportunities are increased costs and political and environmental problems. In addition to the direct "across the border" transmission interconnection

facilities which would be required to permit substantial increases in power transfers, significant internal transmission reinforcement would also be necessary in the Atlantic Provinces and in New England. The capital and operating costs of such transmission system reinforcement could be substantial. If coal-fired plants were to be constructed in New England for export to Canada, their installation could "use up" that region's air quality "margin," thereby inhibiting future economic growth. Public acceptance and New England regulatory attitudes are not perceived as an impediment to short-term sales using existing facilities, since there would be a perception of economic benefit to New England consumers. But the feeling is that construction of new facilities dedicated exclusively to export would meet with public opposition.

In Canada, New Brunswick feels that careful planning can minimize environmental effects of new construction to an acceptable level. The Maritimes' economic policy provides for the construction of generation facilities whose output would be exported in the early years of operation. Such actions create jobs, achieve economies of scale, and the availability of adequate electric energy supply could stimulate the growth of industry in the area. In the New England regional report, the Maritime utilities expressed the feeling that "the successful undertaking of the facilities required for a major international transaction depend, to a significant extent, on avoiding major public opposition." However, due to the beneficial effects on the local economy, the report states that "public perceptions do not, at this stage, force unreasonable delays in the approval process." (See Appendix D)

In sum, while the present generation mix may not justify substantial increases in international transactions, there is some potential in the future due to the following:

- Development of hydro resources might provide the area with less expensive power, derived from a renewable resource. Such development could decrease electricity costs and conserve fossil fuel in both countries.
- Accelerated development of Canadian Maritime coal and nuclear capacity could stimulate the regional economy, but would require a larger market for sale of the energy generated during the early years of plant operation.
- Tidal power development might require an auxiliary market (outside of the Maritimes) or an energy storage capability.

2. Quebec - New England and New York

Quebec's generating capacity is overwhelming hydro-based. In addition to existing capacity, a major hydro project is being constructed at James Bay. (An area whose hydro potential is about 20,000 megawatts.) The output from James Bay will be transported to load centers in Quebec via a 735 kilovolt alternating current transmission system. The United States portion of the Northeast Power Coordinating Council bordering Quebec has mixed generation, with heavy use of oil-fired units.

This difference in generation mix has resulted in large sales of surplus hydroelectric energy by Quebec to neighboring

provinces and to the United States utilities. These sales are considered to be temporary and are made when the available generators exceed the needs of the Quebec province. Increased transactions between Quebec and its neighbors seem likely because of the diversity between Quebec's winter peak load and New York's summer peak load. Also, periods of heavy precipitation will enable Quebec to sell surplus energy to others. In return, if Quebec experiences years of poor rainfall, the thermal generation in the United States could provide some support. The potential for short-term firm sales from construction and/or advancement of major projects may be judged in relation to both the size of the projects currently underway (La Grande 10,300 megawatts) and contemplated (Nottaway-Broadback-Rupert 5,000 megawatts, Great Whale 2,000 megawatts) and in relation to Quebec's stated requirements for an annual addition of 1,700 megawatts of generation in the 1980's. Should the Province's load growth prove to be lower than anticipated, additional short-term surpluses may be available.

Quebec feels⁶ that the public supports its actively marketing its surplus energy because:

- Quebec customers are not paying for energy development for export purposes, since the province needs the capacity of these hydro projects anyway.
- Quebec could realize substantial profits from surplus energy sales, thus reducing rates to its customers.
- Intertie capacity can be used for emergency support

if Quebec requires support during adverse water years.

One complication of Quebec interconnecting with other provinces or with United States utilities is that it cannot operate in synchronism with its neighbors for technical reasons. This is a result of the remote location of most of its generating resources. Consequently, Quebec at present disconnects specific generators from its main system in order to export their energy.⁶ To overcome this problem, a direct current tie to New Brunswick has been built and direct current ties to New York and Ontario are under study. Labrador has significant hydroelectric potential, however, its geographical location north and east of Quebec separates it from both Quebec and United States load centers. The costs associated with transmission of any electricity from Labrador to these load centers would likely be very high.

3. Ontario - New York, Michigan, and Minnesota

Ontario's generation is a mix of hydro, nuclear and coal, with some oil (both base load and peaking). Ontario Hydro is strongly interconnected by 230 and 345 kilovolt transmission lines to New York and Michigan. These connections are located east of Lake Ontario in the Massena, New York area, between Lakes Ontario and Erie in the Buffalo/ Niagara, New York areas and between Lakes Erie and Huron in the Detroit, Michigan area. A 120 kilovolt transmission line crossing the Ontario-Minnesota border serves only a Boise Cascade Company pulp plant. Total transfer capability between the United States and Ontario is over 2,000 megawatts. Electricity exchanges are mostly seasonal, with energy flowing to the United States in summer and being returned to Canada in the winter. Emergency situations such as the recent United

States coal strike may significantly increase this international flow.

Ontario installed generating capacity is 50 percent coal-fired capacity. The Province is heavily dependent on the import of United States coal; the amount of electricity generated from coal imported from the United States is comparable to the electricity exported from all of Canada to the United States in recent years. Ontario is, however, attempting to diversify its sources of coal by utilizing lower sulphur Western Canadian coal.

Interconnections between Ontario and the United States have been justified mainly on the basis of improved system reliability. Historically, the Ontario - United States transfer capability has been adequate to meet virtually all capacity and energy shortfall situations between adjoining systems and to allow the utilities to take advantage of virtually all available opportunities for economy transactions.

The regional input states that Ontario - United States transfer capabilities are expected to decrease due to inadequate internal transmission caused by the recent lengthening of lead times, and the increasing difficulties in obtaining government clearances to build new internal transmission (particularly in Ontario). The utilities involved are concerned that if planned internal transmission is delayed because of licensing and litigation difficulties their interchange capability will be reduced to the level where the interties will not continue to provide reliability enhancement. If this occurs, power and energy exchanges will be seriously curtailed.

The transfer capability between Ontario and the United States on each of the New York and Michigan interfaces is less than the arithmetic sum of the nominal capacities of these interconnections. The flow of power does not divide proportionally to the nominal tie-line capacities because of differences in the electrical characteristics of the interconnected networks. Table 3-1 lists the estimated transfer capabilities between Ontario and Michigan and between Ontario and New York.

A complicating factor in transactions between the United States and Ontario is the flow of circulating power around both Lakes Erie and Ontario. Even with no scheduled power import or export, power flows from New York to Ontario and from Ontario to Michigan or vice versa due to the configuration of the transmission systems. Phase-shifting transformers are used to control circulating flows around Lake Ontario, however, the flows around Lake Erie (Buffalo and Detroit) are of such magnitude that transformers with large phase shifting capability would be required. Detailed operating procedures have been developed to mitigate the impact of these circulating current flows.

If transactions between Ontario and the United States are to be significantly increased, Ontario Hydro's internal transmission system near the international border in Michigan will require reinforcement. The existing Niagara interconnections and internal transmission capacity constraints within the Ontario to Michigan interface are now the limiting factor in Ontario-United States transfer capability. Ontario, New York and ECAR are currently conducting technical and economic studies to see if additional benefits can be obtained from increased transactions. Continued emphasis will be placed on

Table 3-1

Expected Ontario-New York-ECAR Power Transfer Capability in 1980

<u>Transfers</u>	<u>Summer Transfers to U.S. (MW)</u>	<u>Winter Transfers to Ontario (MW)</u>
Ontario and Michigan (zero to New York)	1200 - 2000	600 - 1100
Ontario and New York (zero to Michigan)	1500 - 2200	1300 - 2000
Ontario, Michigan and New York (simultaneous)	2000 - 2700	1700 - 2400

Note:

Transfer capabilities shown are based a range of 0-400 MW circulating current around Lake Erie in a counter-clockwise direction.

the reliability considerations. Specifically, more extensive coordination and planning among the utilities is envisioned, with greater reliance on interconnection for reserve support.

In addition to the present (non-firm) sales of surplus energy, Ontario is considering the firm sales of the output from generating capacity which the utility considers to be surplus to present needs. Additionally, there has been discussion of constructing nuclear reactors in Canada, dedicated to the export of power to the United States. However, public opposition to construction of additional nuclear power plants is growing in Canada, and nuclear expansion solely for export to the United States will necessitate careful explanation of benefits to the Ontario public.

4. Manitoba - MARCA

Manitoba's electrical generation resources are primarily hydro; the Province exports energy to other provinces as well as to the MARCA (Mid-Continent Area Reliability Coordination Agreement) area in the United States. The magnitude and type of transactions between the United States and Manitoba are currently constrained by the existence of only two 230 kilovolt transmission lines. Transactions are further restricted at present because these interconnections exist between adjacent United States - Canadian utilities which have similar winter peaking load requirements; thus there is minimum opportunity for seasonal diversity exchange.

Transmission is limited because, until recently, United States border states could take advantage of nearby lignite fields as a fuel source, and oil-fired peaking capacity generation was an attractive means of serving seasonal peak load requirements for both summer and winter peaking utili-

ties. With the fuel supply problems of the "energy crisis," the resultant sharply rising costs of fossil fuel, and the increased construction costs of generating plants, there is now more incentive to increase the capacity of Manitoba - United States interties in order to take advantage of Manitoba's less expensive hydro energy and to realize seasonal diversity benefits.

Two major transmission projects have begun which will take advantage of the opportunities for increased Manitoba - United States transactions within the MARCA region (see Table 3-2). The Winnipeg - Twin Cities interconnection will be used to transfer power and energy from Canada to the United States in the summer, and from the United States to Canada in winter.* In addition, Manitoba will sell Northern States Power surplus energy in summer and, initially, some firm power. When adverse water conditions prevail, Northern States Power will provide energy support to the Manitoba Hydro Electric Board in winter.

The potential for seasonal diversity exchanges increases proportionately with the north/south distance traversed. A major transmission line connecting Manitoba and Nebraska has been proposed. This project (known as MANDAN) will exploit this load diversity by connecting winter peaking utility systems in Canada and North Dakota with summer peaking systems in South Dakota and Nebraska.

* However, if natural gas supplies become short for Northern States Power, whose service area relies heavily on gas space heating, a growing electrical space heating load could negate the seasonal diversity now present between NSP and MHEB.

Table 3-2

Major International Interconnections

MARCA - Manitoba Region

Project Name:	Winnipeg-Twin Cities	MANDAN
Province:	Manitoba	Manitoba
State(s):	Minnesota	Nebraska & Dakotas
In Service:	1980	1985
Voltage:	500 KVAC	±450 KVDC or 500 KVAC
Primary Purpose:	Exchange of Seasonal Diversity	Exchange of Seasonal Diversity
Project Status:	Canadian Export License granted U.S. Export License Scheduled for Issue in February 1979	No Application Received from Either Federal Government

The MANDAN transmission line will also facilitate transactions for seasonal diversity, economy exchange, energy storage, and replacement for adverse water conditions.

Manitoba has over 6,000 megawatts of undeveloped hydroelectric resources in the north of the province with 12 sites on the Nelson-Burntwood-Churchill River system. These sites range in size from 103 megawatts to 1,270 megawatts. At current, anticipated rates of load growth, it is estimated that only 50 percent of these resources will be required to meet Manitoba's needs until the year 2000, so that there is a large potential for export of hydroelectric energy if construction of these hydroelectric projects is advanced.

Another United States - Canadian interconnection presently being discussed is a 500 kilovolt alternating current transmission line between Brandon, Manitoba and the Bismark, North Dakota area. This line would be used to enable North Dakota to purchase the total output of a Canadian hydro generating station until the station's output would be needed for Canadian requirements.

Because of the tremendous incentives in exploiting seasonal diversity and hydro-thermal system support, the projects in Table 3-2, designed to overcome the present transmission constraint on international transactions, are being speeded to completion. The Winnipeg-Twin Cities tie is expected to be in service in 1980. MANDAN is to be placed in service at the earliest possible date, expected to be 1985.

5. Saskatchewan - MARCA

Saskatchewan's utility facilities are interconnected with those in Manitoba, but there are currently no direct ties

with United States utilities. While Saskatchewan's energy requirements and those of neighboring states are supplied primarily from coal fired generation, interconnection with the United States is contemplated for reasons of seasonal diversity. The Boundary Dam coal fired generating station - Tioga transmission project is scheduled for completion in 1981. It will link Saskatchewan and North Dakota by a 230 kilovolt transmission line, with 200 megawatts of transfer capability. The project's principal purpose will be a 100 megawatt seasonal diversity exchange between the Saskatchewan and North Dakota systems.

6. Alberta - Western Region

Alberta is interconnected with British Columbia, but has no bulk transmission ties with the United States. Alberta has large resources of subbituminous coal; the Province plans to use this to fuel its new generating capacity. Also, coal from Alberta is being shipped to Ontario to diversify its coal supplies. The surplus energy versus firm capacity complementary natures of hydro- and thermal-based utility systems was mentioned earlier. Alberta's coal resources can thus complement British Columbia's hydro generation. When coupled with the National Energy Board's stipulation that Canadian provinces must be given first refusal on any export power, closer ties between Alberta and British Columbia may be desirable, while there seems to be little incentive to strongly interconnect Alberta and the United States portions of the WSCC. Any interchange between Alberta and the WSCC is likely to be through British Columbia.

In Alberta, the construction of a 500 kilovolt interconnection to British Columbia in 1983 should make available surplus energy on the order of 2,000 gigawatt hours per year, the major portion of which would be reasonably firm. Beyond 1986

it should be possible to advance coal-fired thermal generation facilities in unit sizes providing about 2,600 gigawatt hours per year. Alberta currently has under investigation two hydroelectric projects with a combined potential of about 12,200 gigawatt hours per year. These are a possibility for the early 1990's and might be developed ahead of Alberta's requirements if they prove viable.

7. British Columbia - Western Region

Both British Columbia Hydro and the United States Pacific Northwest are hydro-based systems with increasing amounts of thermal capacity planned (coal for the former and both coal and nuclear for the latter). There are no plans for additional interconnections between British Columbia and the contiguous United States. To the contrary, construction of several large thermal plants in the United States Pacific Northwest may cause a reduction in the existing British Columbia to Washington State power transfer capability by placing lower operating limits on existing international ties. Increased transmission usage within the British Columbia Hydro system could also limit the future transfer capability, unless the transmission facilities are reinforced with consideration being given to the international exchange of electricity. However, a limiting factor on British Columbia - United States increased power transfers is not the capacity of the transmission lines crossing the international border, but the north-south capacity of transmission interties within the Western United States from the Pacific Northwest to the Pacific Southwest.

Because of the seasonal load variations between the Pacific Northwest (winter peaking) and the Southwest (summer peaking), and the advantages of coordinating the planning and

operation of hydro (Northwest) and thermal (Southwest) utilities, there is great interest within the United States in increasing the north-south interstate intertie capability. Increase of this north-south transfer capability would also enable greater seasonal diversity exchanges to take place between British Columbia and the Southwest. Three proposals for supplementing the present intertie capability with the Pacific Southwest are under consideration. One proposal is to construct the second direct current line that was part of the original intertie system approved by Congress in 1964. The second proposal is to build a third alternating current line from the Pacific Northwest to northern California. The third proposal is to increase the capability of the existing direct current line. The Bonneville Power Administration resources staff is engaged in intensive analysis of the capabilities of the resources of the Pacific Northwest and Bonneville to support the power sales and/or exchanges necessary to the lines' feasibilities. Transactions under consideration for the existing and proposed lines include: extension of the existing capacity/energy exchange contracts; diversity capacity exchange with concurrent energy return and also with deferred energy return; capacity sale; energy sale; and reserve pooling. Important factors which impact the choice of transactions are generating resource delays affecting the load/resource balance in the Pacific Northwest and the ability of the Pacific Northwest system to accept offpeak energy.

Presently, transactions between the United States and British Columbia are mainly interruptible sales (surplus energy), seasonal exchanges, and treaty deliveries (see Table 3-3). For the future, British Columbia (depending on river storage and snow pack conditions) would be able to offer small amounts of firm energy (possibly up to 1,750 gigawatt hours

Table 3-3
Electricity Transactions Between British Columbia and the United States

<u>Transaction Types</u>	<u>1975</u>		<u>1976</u>		<u>1977</u>		<u>Jan. 1 to July 31, 1978</u>	
	<u>(Gigawatt Hours)*</u>		<u>(Gigawatt Hours)*</u>		<u>(Gigawatt Hours)*</u>		<u>(Gigawatt Hours)*</u>	
	<u>Canada</u>	<u>U.S. to</u>	<u>Canada</u>	<u>U.S. to</u>	<u>Canada</u>	<u>U.S. to</u>	<u>Canada</u>	<u>U.S. to</u>
	<u>to U.S.</u>	<u>Canada</u>	<u>to U.S.</u>	<u>Canada</u>	<u>to U.S.</u>	<u>Canada</u>	<u>to U.S.</u>	<u>Canada</u>
Firm Sales	27	0	0	0	1,202	0	136	0
Interruptible Sales	850	273	1,931	25	3,767	0	1,205	76
Exchanges	67	77	51	214	944	889	151	667
Treaty Deliveries	1,078	0	0	0	36	71	12	17
Wheeled Power	860	843	2,054	2,014	453	453	365	365

*One gigawatt hour equals 1,000 megawatt hours.

per year) for periods normally less than one year in advance. Beyond 1987 the advancement of new hydroenergy and coal-fired thermal generation might allow firm exports up to 1,750 gigawatt hours per year until about 1991. After 1991 it might be possible to develop considerable firm exports from northern river developments, which could rise to about 8,700 to 13,000 gigawatts hours per year by 1994.

If additional firm electric power and energy were available from Canada, it would enhance the existing interest in increasing the interconnection capacity to the 500 kilovolt alternating current lines and of the direct current intertie from the Pacific Northwest to California.

The potential of energy center developments in the United States could provide short-term surpluses for export to Canada. Surplus energy in the United States Pacific Northwest, if stream flow conditions are higher than in Canada, could be sold to Canada. However, the Bonneville Power Administration does not foresee significant additional transactions from the Northwest to Canada.

8. The Yukon and British Columbia - Alaska

Alaska shares 1,538 miles of common border with Canada's Yukon Territory and the Province of British Columbia. Alaska and neighboring parts of Canada are characterized as frontier areas with few people, and relatively little development. Activities conducted across the border are generally concentrated along a few natural transportation routes in Southeast Alaska and the main river valleys in the Yukon River Basin. Small isolated power systems on both sides of the border have developed independently. Long distances, difficult terrain,

and comparatively small power demands have outweighed potential advantages of interconnected systems in the past.

However, Alaskan electric power demands have been growing rapidly, along with significant expansion of in-state generation and transmission systems. Further expansion of Alaskan power systems, together with major northern resource developments, could lead to circumstances favoring interconnection between power systems. Hydroelectric and coal resources are the most likely choices for future Alaskan power production. Figure 3-1 shows existing and proposed energy facilities in the Alaska - Yukon area.

Future Alaska - Canada interchanges will probably be of two types:

- Interconnection between neighboring systems to facilitate use of essentially local power resources. Additional transmission capacity required would be relatively small.
- Interconnection associated with major resource developments. These could lead to large power flows across the border.

There are three other potential interconnections involving Southeast Alaska. First, the city of Ketchikan, Alaska, is within approximately 80 transmission miles of the existing British Columbia Hydro power system. Conceptually, an underwater direct current intertie would enable Ketchikan to purchase power from British Columbia Hydro. Such a tie might

also facilitate development of local hydro resources in the vicinity of Ketchikan.

Next, hydroelectric resources in British Columbia's Stikine River basin are situated relatively close to the Alaskan communities of Petersburg and Wrangell. If their resources are developed, both Petersburg and Wrangell would be potential power customers.

Third, long range consideration also includes the potential development of a regional transmission system for Southeast Alaska extending from Ketchikan to Skagway and including service to Petersburg, Wrangell, Juneau, and Haines. This type of system would encourage development of strong interties with the Canadian system.

It would be technically feasible to transport large amounts of power generated in Alaska and neighboring areas of Canada to major load centers in southern Canada and the Pacific Northwest. Such a plan may be of interest in connection with major hydroelectric development or large thermal plants. Transmission technology is not a limiting factor.

The development of generation in Alaska for markets in the United States would require planning and construction of a coordinated electrical transmission network between Alaska, the Yukon, British Columbia and the Pacific Northwest States.

4. OBSTACLES AND CONSTRAINTS TO INCREASED TRANSACTIONS

Obstacles are those elements, such as excessive jurisdictional or regulatory complications, which are subject to removal or mitigation by means of governmental policy initiatives or changes at the federal, state, or provincial level. Constraints are considered to be necessary requirements, such as regulatory processes, which determine whether proposed transactions are in the public interest.

A major purpose of this study was to obtain the regional utility perceptions of obstacles and constraints to increased international transactions, so that a determination could be made as to what new or changed policy actions by the federal, state, or provincial governments would be appropriate to eliminate the obstacles and mitigate the constraints. This chapter, therefore, deals with the perceptions of the utilities as reported in their regional reports.

UNITED STATES

1. Jurisdictional Constraints

The overlapping jurisdiction of state and federal governmental authorities with respect to licensing requirements and permit acquisition for exchanges of energy across international borders is perceived by many electric utilities to be a major obstacle to additional international transmission lines or increased electric energy transactions with Canada. Overlapping jurisdiction creates redundant regulatory requirements which result in lengthy procedures and increased costs for proposed utility projects. The potential for lengthy time delays is also increased. Such possibilities create

apprehension and may discourage utilities from committing project funds, thus decreasing the probability that viable projects will be undertaken.

In the United States, a federal permit is required for construction, operation and maintenance of transmission facilities at an international border. This permit is issued by the Secretary of Energy after obtaining the concurrence of the Secretary of Defense and Secretary of State. Any transmission of electrical energy across international borders also requires authorization by the Secretary of Energy. The Department of Interior may exercise some jurisdiction if a proposed line route crosses federal lands, Indian reservations, national wildlife refuges, or critical habitats. The United States Army Corps of Engineers may also become involved if construction of transmission facilities across any navigable waterway in the United States is necessary.

State public utility commissions often have jurisdiction over transmission facilities for the exchange of power with Canada since they (States) have the authority to regulate electric generation and transmission facilities utilized in foreign commerce, provided such facilities are not also utilized for interstate commerce. Since the federal licensing authority applies only to the border crossing itself, states may require compliance with their own laws, rules and regulations regarding line routing, design and operation. Many states now have energy facility siting laws which require review and approval by state agencies, counties and towns.

2. Regulatory Restrictions

The regulatory obstacles to increased sales by the United States utilities to Canadian utilities are primarily economic

in nature. With the recent lengthening of lead times and the increasing difficulties being experienced in obtaining government approvals for building new generating and transmission facilities, there is growing concern that electric energy interconnection transactions will decrease. For long-term firm sales the purchasing utility must have confidence that generation, internal transmission and interconnection capacity will be added as required and that the power transfer capability will be maintained for the duration of the contract. Firm sales also require long-term assurances regarding price.

United States federal statutes permit arbitrary and unilateral curtailment of deliveries by the Secretary of Energy in the event of a national emergency. For firm sales to be a viable and realistic option for the utilities, assurance is needed that unilateral government actions will not alter the original terms of contract.

As mentioned earlier, state regulatory approval is required for the construction of new generating facilities. State regulatory agencies must consider such issues as need for power, environmental impact, economics, alternative technologies and sites. Electric utilities anticipate that state regulatory approval would not be forthcoming in the absence of significant economic advantage to the citizens of the state, coupled with general public acceptance and political support. State regulatory approval is also required for transmission line construction. Since an international bulk power exchange transmission line may traverse several states, the approval process would be complicated and delayed. This serves to increase the degree of uncertainty felt by many utilities regarding the regulatory process.

3. Environmental and Land Use Constraints

Environmental and land use constraints are essentially part of the regulatory process because that is the forum where environmental impacts are assessed. An Environmental Impact Statement (EIS) is required whenever federal agencies propose to take any major action which may affect the quality of the human environment. Potential obstacles are created due to the sheer volume and complexity of Environmental Impact Statement data required. This preparatory work is the responsibility of the federal government following receipt of significant input from the applicant.

The controlling environmental factors, as viewed by some utilities, is the unwillingness of the public in one area to dedicate and use its environmental resources for the benefit of another area. If the construction of coal-fired plants in the United States were to be considered as likely power sources for export to Canada, then consideration would have to be given to air quality regulations and in particular whether or not the installation of a coal-fired power plant would "use up" some of the air quality "margin" and thereby inhibit future industrial growth of that region.

Future interconnection proposals between Alaska and Canada may be significantly affected by the environmental questions which will inevitably be raised regarding land use. Pending proposals for wilderness areas and other conservation efforts may preclude using natural transportation corridors for transmission of electricity.

Land use restrictions present obstacles to United States - Canadian power and energy exchanges because acquisition of transmission line rights-of-way at fair cost is often

impeded. The time element and uncertainty associated with land use conflicts increase acquisition costs. Potential difficulties associated with line routings and jurisdictional border crossings occur when federal, state and Canadian agencies are concurrently involved in designating acceptable transmission corridors, and extensive coordination is required to insure that all line segments will connect. These problems, although not insurmountable, result in increased time delays, which extend the lead time and cost required for project completion.

4. Financial, Economic, and Technical

Before increasing transactions, utilities must be able to show that the overall benefits will outweigh the costs. Several financial, economic, and technical factors which characterize the present United States situation may present constraints or obstacles to increased international transactions by negating some or all of the potential benefits mentioned in Section 3.

Increased transactions may require construction of new transmission lines, substations, or generating facilities. The concomitant capital outlay associated with such construction is perceived by the utilities to present financial obstacles and complications which may hinder expanded transactions. Utilities are finding it increasingly difficult to raise capital for construction. This is a result of the high cost of money and rising fuel prices, which increase the cost; and regulatory delays, which extend the lead times; therefore extending the time before a utility can begin to receive any return on their investments.

In a capital-short situation, utilities find it difficult to use their existing equity to finance power plants that will serve people other than their own customers. New England utilities, in particular, feel that they cannot finance construction in advance of their forecasted needs unless long-term commitment is made by the purchasing entity. This is difficult to do because: utilities purchasing power may not wish to commit to that purchase for the 10-to 15-year term required; and, Canadian international permits and export licenses are limited to 25 years by statute and are usually issued for terms of 5 to 10 years and some for 10 to 15 years.

Finally, with the added complexity of transactions across an international border (more government agencies have jurisdiction, more permits and approvals must be obtained, etc.), the ability of the utility to carry a construction project to a successful and timely completion becomes more uncertain. This uncertainty makes it harder for the utility to obtain financing.

For financing to be obtained, a project must be shown to be economically feasible. When two utilities interconnect, the benefits usually include both economies of operation and improved reliability. The reliability benefit, with its potential for major capital savings, is extremely important; improved reliability and reserve sharing have been used to justify many of the Canada-United States interconnections. However, once utilities are interconnected, additional tie lines may not give proportionally more reliability benefits. Since the United States and Canada are strongly interconnected in many regions, additional transmission ties may be difficult to justify from a reliability point of view.

Operating benefits accrue when one utility can sell electricity to another at a lower price than the latter can produce it itself. However, wheeling charges and transmission losses over long distances through several intervening systems may reach levels which result in uneconomic total costs to the parties, thereby nullifying the benefits of such transactions. It is the perception of some Canadian utilities that wheeling charges in the United States present a significant obstacle to increased transactions when there are several utilities intermediate between the contracting parties.

The volatile nature of fossil fuel prices and the uncertainties in load and resource forecasts and construction, mean that there cannot be long-term guarantees of the price or reliability of inter-utility transactions. United States utilities cannot pass costs associated with purchased power along to their customers in the same manner as they can pass along increased fuel costs. With all these uncertainties (e.g., prices, lead times, permit approvals, etc.), many United States utilities feel Canadian utilities will not commit themselves to construct facilities for export to the United States unless the prospects appear extremely attractive.

For any transactions to occur, they must be technically and economically feasible. For example, the Alaska-Yukon region, characterized at present by low levels of development, small population, long distance, and rough terrain, is not conducive to increased interconnection and offers little incentive, unless there are major regional resource developments.

In the United States, many utility systems will require internal transmission to be reinforced (e.g., in Washington) before increased international electricity transfers can be

achieved. System stability or spinning reserve problems might also affect the amount of power that can be imported. Longer transmission distances make it more difficult to assure system stability and control frequency. When a utility is importing a large amount of power, it must provide operating reserve to cover any sudden, unexpected loss of a portion or all of the imported power.

Fuel availability may also be a technical constraint on international transactions. If fuel is not available to generate electricity, then international electricity exchanges may not occur.

A final technical constraint for some utilities is that they perform maintenance on large generating units during off-peak seasons. Therefore, the capacity available to generate electricity is often less than the installed capacity shown in Table 2-2. As a result, the seasonal diversity in reserve margins (Table 2-4) may be less than shown in the Load and Resource Forecasts section.

5. Political Constraints

Political obstacles and constraints often arise from conflicting or overlapping regulatory jurisdictions. As a result, parochial interests often conflict with national goals. Importing power does not contribute to a municipality's tax base, as does constructing indigenous generation. Utilities in the Pacific Northwest feel that exports to Canada should be curtailed if such exports would deprive the United States Northwest of low cost hydro-energy at the present time or in the future.

6. Public Acceptance

Utilities feel that the public is not generally in favor of exporting electric power to another region or another nation. In many states, the public does not wish land in its area to be used, or area pollution increased, to provide electricity to customers outside of the state (either to another state or to another country). Utilities feel that, with the present public feeling against new generation and transmission construction, the construction of facilities dedicated to export would prove to be unpopular.

CANADIAN OBSTACLES AND CONSTRAINTS

The regional reports, provided in the appendices, identify a number of obstacles and constraints to increased transactions. This subsection deals with these obstacles and constraints, from the Canadian viewpoint and in the order listed in the terms of reference.

1. Jurisdictional Constraints

In general, within Canada, jurisdiction between federal and provincial authorities is fairly clearly defined and jurisdictional problems are minimal. This is undoubtedly due, in large measure, to Canadian geography which means that only one Canadian province is normally involved in an exchange transaction, whereas several states in the United States may be involved in a similar situation. Other provinces, not involved in a given transaction, may of course become intervenors in National Energy Board proceedings and provide alternative markets for proposed exports. The National Energy Board and provincial Departments of the Environment both have responsibilities with respect to the environmental

aspects of international transmission ties, but such shared responsibility has not to date raised major problems. Additionally, there is a requirement for environmental review by the federal Department of the Environment for any project involving federal ownership, financial assistance or land. However it is expected that such cases would be few and that the required review would be coordinated through the National Energy Board.

In some cases difficulties and delays have been experienced in obtaining clearances for new or reinforced internal transmission. There is concern that this will reduce the interchange capabilities to such an extent that the interconnections will not fulfill their system reliability requirements.

With respect to international jurisdiction, some export proposals could involve United States waters not covered by the International Joint Commission and in such cases specific treaty negotiations between Canada and the United States would be necessary. Matters involving air quality effects from Canadian thermal power plants have traditionally been handled on a bilateral discussion basis between the concerned governments and it is anticipated that such negotiations would be applied to facilities used for export purposes.

2. Regulatory Restrictions

In general, there is a perception that the National Energy Board has administered the regulations with respect to electricity exports in a consistent and reasonable manner. However, it is felt that increased latitude and clearer definition of licensing rules would be desirable to increase the attractiveness of the exports and to reassure buyers as

to timing, length of term and security of supply, leading to increased possibilities for firm power transactions.

There is widespread belief that a licensing provision exists whereby a firm export contract can be interrupted for reasons of national interest. This introduces a measure of uncertainty which reduces the reliance that a United States purchaser can place on the Canadian supplier to meet firm power requirements and makes it difficult for United States utility to modify its generation development program to take advantage of potential Canadian energy supplies.

It is also believed by many that because the National Energy Board has a pricing rule that requires that the price of an export be not materially less than the least cost alternative in the United States, no significant saving can be achieved from Canadian energy purchases. Thus, proposals for developments of generating facilities in the United States should be favored over external purchases.

It has been pointed out that time periods involved in the initial application and licensing process, coupled with the uncertainties regarding final outcome, make it difficult to undertake major capital facilities with a major export involvement when opportunities present themselves. The limitations being placed on the length of time for which exports can be licensed is also seen as a negative factor in justifying major transmission additions which normally require long-term write-off.

3. Environmental and Land Use Constraints

Transmission and generation developments are subject to environmental review by provincial governments. The transmission lines over which power is to be exported and any generation facilities directly involved are also subject to environmental assessment by the National Energy Board. Experience has been that environmental review procedures and required actions can be difficult, time consuming and costly. However, careful consideration of location, minimization of environmental effects, and observance of established procedure of assessment and approval can minimize problems with the regulatory process. In general, there is the perception that increased exports would be subject to increased challenges from environmental groups who place greater emphasis on pollution aspects of exports than on benefits accruing from these transactions.

4. Financial and Economic Considerations

Recent inflationary pressures have tended to strain the financial capacity of electric utilities to undertake high capital projects. Requirements for increased investment in high capital cost projects dedicated to the export market would exacerbate this situation.

Financial limitations also arise in the sense of inability to justify major transmission interconnection additions due to limited terms of licensing and the short periods for which the surpluses are often available for export. The economic justifications and the financial investments required become difficult due to the limited period of clearly definable use. Justification then becomes dependent on longer term and less definable benefits.

5. Political

There is a perception of insufficient federal and provincial political support for electrical energy exports and the need is seen for political leaders to adopt a positive stance on the benefits to be derived from such exports.

6. Public Acceptance

This subject is obviously strongly linked to the political aspect and the general perception is that, since strong opposition is expected against building facilities for export purposes, positive support from political levels is essential.

COMMON OBSTACLES AND CONSTRAINTS

Increased electric energy exchanges between the United States and Canada are limited by several obstacles and constraints which are common to both countries. Utilities in both countries report that they are faced with numerous regulatory requirements which tend to hinder the economic attractiveness and technical feasibility of large construction projects dedicated to electricity exports. The uncertainty of gaining an economic return on the required investment and of obtaining the necessary approvals on a timely basis, as well as the costs of preparing applications for construction and/or export permits, have made utilities hesitant to embark on programs of more extensive international electricity transactions. Uncertainties regarding the duration of export authorization and the environmental impacts of constructing new facilities or generating more electricity have also combined to make joint projects less attractive. There are additional uncertainties in projecting generating resource requirements, estimating available resources, and raising capital, all of which affect the economic

feasibility. Finally, the support of the public in both nations for the construction of facilities dedicated exclusively to export or using their area's resources to benefit another area will be difficult to obtain.

5. PROCEDURES TO RESOLVE OBSTACLES AND MINIMIZE CONSTRAINTS

UNITED STATES PROCEDURES

Many of the obstacles and constraints identified by United States utilities which hinder (or have the potential for hindering) increased transactions between the United States and Canada are, in fact, similar to the obstacles and constraints that hinder increased interchange transactions among intra-United States utilities.* These obstacles and constraints, as discussed previously, generally relate to problems of economics, public acceptance, complex regulatory requirements, and to the uncertainties associated with these and other circumstances surrounding typical utility expansion plans. Increased international electricity exchanges are often constrained by the conflicting objectives of utilities, consumers, federal government, state government and various public interest groups.

Economic evaluations which result in negative decisions are often rooted in the uncertainties presently surrounding the utility business environment. No single action on the part of the various entities concerned with utility regulation can eliminate the many difficulties leading to these uncertainties. A general improvement in the overall utility business environment, resolution of questions about appropriate power wheeling charges, and the provisions for a purchased power adjustment clause (similar to a fuel adjustment clause) for example, would likely lead to increased incentives to expanded transactions with Canadian utilities.

An obstacle is considered to be a blockage or problem while a constraint is a limitation or restriction.

Where electricity exchange projects are contemplated, concurrent proceedings on the part of the federal regulatory agencies in both countries appear to be desirable. Such proceedings would ensure that data and issues involving both countries are the same and receive appropriate attention. In particular, circumstances requiring United States - Canadian federal government actions should be identified by electric utilities sufficiently early in the planning process to minimize time delays. Increased dialogue and data exchange between the Canadian National Energy Board and the United States Department of Energy would be an appropriate action.

In many instances, the various obstacles, constraints and difficulties perceived to be associated with expanded transactions arise from incorrect information or perceptions on the part of one or more of the concerned utilities. This may involve perceptions of legal, national policy, economic, regulatory or other considerations that, in fact, do not apply. Increased utility/government dialogue would be helpful in ameliorating this problem.

Two key intertwined issues surrounding the concept of regional (both intra- and inter-United States) electricity transfers are the perceived benefits of such transactions and the problem of public acceptance. For the most part, the public tends to take a parochial view towards exporting local natural resources in the form of electricity for the benefit of others outside their immediate geographical, economic, and environmental domain. Furthermore, the quantification of benefits resulting from such transactions and their allocation can be subjective. It is important, therefore, that the benefits (both short- and long-term) be explained to the general public in order that an informed consensus can be reached.

Finally, in the face of the many uncertainties, obstacles, and other constraints that exist to impede expanded United States - Canadian

transactions, it is important that positive incentives in the form of appropriate regulatory policies be instituted. A statement of current policy by both countries regarding electricity exports and pricing would also be useful.

CANADIAN PROCEDURES

Since the jurisdictional situation in Canada does not appear to be causing serious problems, there is no evident need to call for federal remedial actions of a policy nature.

In the regulatory area, a number of improvements may be advisable. The regions' perception that the National Energy Board has the power to interrupt a firm power export for reasons of national interest is inaccurate. The National Energy Board does not have such power; it may revoke a license only for reasons of non-compliance with licensing provisions and only after convening a public hearing and obtaining the approval of the Governor-in-Council. Therefore, in a firm export license there would be no mention of withdrawal of power to meet Canadian needs.

In one case the National Energy Board denied a firm export because the information supplied to the Board did not, in the Board's judgment, demonstrate that the proposed export was indeed surplus to Canadian requirements. Part of the problem in this instance was that the information supplied by the utility was, due to time taken in negotiating the export contract and carrying out the regulatory process, some two years out of date, and conditions had altered in the meantime. This case illustrates the need for minimization of the time required for contract negotiations and the regulatory process and for efforts to be made to clarify, for utilities contemplating firm imports, the general philosophy which the National Energy Board uses to guide its interpretation of the National Power

Policy in making its decisions. (However, the issuance of such information must in no way be interpreted as compromising the Board's ability to judge future submissions.) With regard to the time occupied by the licensing process and uncertainties as to the final outcome, it may be said that the National Energy Board endeavors to cooperate with the applicants as much as possible both in ensuring that the license processing period is as short as possible and that the information is complete enough to reduce the uncertainties as to the final outcome. However, the Board is constrained in that it cannot make any commitment prior to completion of the hearings. The Board is normally able to issue an export license within one year of receiving the application and before commitment to plant construction.*

With regard to the National Energy Board pricing rule which requires that the price of an export be not materially less than that of the least cost alternative in the United States, it should be noted that the Board has always exercised a great deal of discretion in applying this rule and given recognition to the necessity of providing a sufficient financial incentive to the purchaser in light of any large capital outlays on transmission facilities which may be involved. A case in point is that of the existing Hydro Quebec - Power Authority of the State of New York contract. The Board also takes into account the time span necessary to justify the write-off of a major transmission facility in determining the length of term for which the export will be allowed, within the existing legal limitations of the twenty-five year maximum period. Recent decisions have granted licensing periods of twelve-thirteen years.

*

See Appendix C, Letter from the National Energy Board to All Electrical Licensees, February 19, 1976.

Where facilities, ultimately needed for Canadian use are developed earlier than would otherwise be required solely for Canadian needs, the environmental and land use effects are only those minimal effects related to the export transaction itself. For hydro developments, the land requirements for generating sites and for water storage are the same. Additional land may be needed for international transmission facilities, but some of the impact of this may be traded off against the benefits to be realized from the export. Also, if reserve requirements are reduced in the Canadian system, by virtue of an international interconnection, environmental impacts associated with planned Canadian facilities may be deferred or obviated. When facilities are specifically constructed for the export of electricity, a more critical evaluation of the environmental and social costs and land use aspects would be appropriate, to ensure that overall benefits to Canadian society accrue from the export transaction.

Where exports are generated from combustion of fossil fuels, air quality may deteriorate. In particular instances, fuels burned in Canada for export may be offset by reduced combustion of fossil fuels in immediately adjacent areas of the United States, and net impact on a joint air-shed may not change. Indeed, if the export transaction maximizes the use of higher efficiency units in either country, the total fuel burned and, hence, the total impact on air quality will be reduced.

At least part of the answer to minimization of the time occupied by environmental land use reviews is increasing acceptance at the federal and provincial political level of the need to provide accurate information on the trade-offs between environmental and land use impacts and social benefits. The need for such responsibility is, of course, not confined to cases involving exports.

It is recognized that financial constraints imposed on some utilities by the provincial governments in response to recent inflationary pressures have increased the challenges of justifying the capital investment required to provide the facilities for export. Nevertheless, exports can provide a number of benefits which tend to reduce domestic power rates. For example, larger sized generating units and more rapid completion of multi-unit generating plants can provide temporary surpluses for profitable sale as well as lower long-run costs for the exporting utility. Also, transmission facilities built for export needs can provide additional benefits that may not be identifiable at the time of construction, such as seasonal diversity interchanges and shared reserve capacity in emergencies.

As mentioned under regulatory consideration, it is recognized that licensing hearings must take account of the fact that the magnitude and duration of an export are critical factors in determining its economic and financial justification.

There is little doubt that the Canadian public has a tendency to look askance on the export of electrical energy, viewing it as the export of a natural resource which might be used to better advantage in producing other finished products for export. This points up the necessity for federal and provincial political leaders to take a more positive attitude in explaining the benefits to be derived from such exports.

The chief benefits of such exports are that they permit economies of scale in generating facilities, permit construction of facilities at a lower cost than would be the case if they were constructed later and only as required by domestic purposes, and that they permit the derivation of profits or like benefits which reduce the cost of electricity to Canadian consumers. They may also permit more

orderly development of Canadian manufacturing capacity and skilled manpower and, in the case of nuclear, they provide upgrading of a natural resource (uranium) to a processed fuel (electricity). Offsetting considerations include the greater amounts of capital required and some potential strain on the capability of Canadian manufacturing from shortages of skilled manpower on occasion.

Such justification may be less difficult where the export is provided from a renewable resource such as water power, although there is some evidence of negative public reaction to "tying up" such renewable resources. But where non-renewable resources such as fossil fuels and uranium are involved, exports may still be justified if there is, on balance, a net social benefit to the Canadian public. Positive long- and/or short-term benefits should be demonstrated clearly, though the fact that such a criterion is not necessarily used for other export products and commodities indicates an inconsistency in public perception.

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APPENDIX A

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**TERMS OF REFERENCE FOR STUDY ON OPPORTUNITIES
FOR EXPANDED CANADA-U.S. ELECTRICITY EXCHANGE**

1. List the interconnections now in service, their capacity and the transfer capability of the different interfaces.
2. Describe firm and tentative plans for additional interconnection capacity.
3. Identify and define the generic types of transactions that take place on interconnection.
 - (a) Economy
 - (b) Short-term firm
 - (c) Intermediate and long-term firm
 - (d) Dedicated facilities
 - (e) Seasonal diversity
 - (f) Source diversity (fuel)
 - (g) Reserve sharing
 - (h) Other
4. Provide data on the magnitude of the various types of transactions that have taken place the past few years.
5. Identify reasons and obstacles in each country by region why the transactions in item 4 are not greater or other types are not employed.
 - (a) Jurisdictional
 - (b) Regulatory
 - (c) Environmental
 - (d) Land use
 - (e) Financial and Economic
 - (f) Political
 - (g) Public Acceptance
6. Identify specific opportunities in each country, by region, for increased imports and exports. List obstacles affecting these transactions.
7. Suggest procedures to resolve obstacles. Recommend action by governments (federal, provincial, state), utilities, regulatory bodies, others.
8. Appendices - provide documentation or references to statistical and other data as necessary to support items 1 to 7.

APPENDIX B

U.S. FEDERAL AUTHORIZATION PROCEDURES

- United States Electrical Power Export Authorization Procedures
- Presidential Documents, Executive Order 12038, February 3, 1978
- Executive Order 10485
- Federal Power Act, Part II, Section 202(e,f) (As amended August 7, 1953)

APPENDIX B

UNITED STATES ELECTRICAL POWER EXPORT AUTHORIZATION PROCEDURES

The United States Federal government has regulatory authority over the exports of electric energy, and must formally authorize the construction of international electric power lines. The authority currently rests with the Secretary of Energy who has delegated that authority to the Administrator of the Economic Regulatory Administration (ERA). Two separate authorizations are issued by the ERA:

- Permits authorizing the construction of electrical transmission facilities at the international border (Presidential Permit)
- Authorization to export electrical energy across the international border

Executive Order 10485, issued September 3, 1953, established the requirement for Presidential Permits. Construction of every line crossing the international border, regardless of size, must be authorized by a Permit. When an applicant applies for a Presidential Permit, a review of the environmental impacts of the line is conducted. The scope of the environmental review would entail the entire project associated with the transmission line. If it is determined that the proposed project could have a significant impact on the environment, an Environmental Impact Statement must be prepared. The public is given opportunities to comment on environmental impacts and the permit application. If public concerns warrant, hearings are held.

In addition to Federal environmental requirements, State governments have route selection and environmental requirements that must be satisfied. After the Environmental Impact Statement is completed, the Administrator of the ERA will weigh the environmental, technical, and economic considerations of the application and make a decision to issue a Permit or to reject the application. If he decides to issue the Permit, he will then request concurrence from the Secretary of Defense and the Secretary of State. If differences between the Departments cannot be resolved, the matter is referred to the President who will make the final decision.

Authorizations to export electrical energy are required of non-public utilities in accordance with Section 202(e) of the Federal Power Act. Public utilities (Federal, State, or Municipal) are not

within the jurisdiction of Part II of the Federal Power Act and do not require an authorization.

Applications for an authorization must set forth specific information and include required exhibits. Applications must include:

- Proposed rates
- Characteristics of electrical energy to be exported (i.e., amount, maximum rate (KW), voltage, etc.)
- Characteristics of electrical energy to be imported
- Statement of reasons why the proposed transmission would not impair the sufficiency of electric power supply within the United States

Required exhibits include:

- Copy of rate contracts under which the energy is to be transmitted
- Statement of financial relationship between applicant and any other involved person or corporation.

The ERA may require additional information relevant to the application. Normally, Environmental Impact Statements are not required.

As with Presidential Permits, public notices are published and hearings may be held.

The ERA will review the proposed rates and compare them to equivalent rates within the United States. After considering all the available information, the Administration will deny, grant, or grant with conditions, the authorization.

There is no set term for the authorizations, and they may be modified by the ERA Administrator as he finds necessary.

Utilities authorized to export electric energy are to fill all subsequent rate schedules, supplements, etc., pertaining to the exports. In addition, they must report to the Administrator the actual annual imports and exports of electrical energy, related costs and revenues, and the maximum rate (KW) of exported energy.

PRESIDENTIAL DOCUMENTS

TITLE 3 -- THE PRESIDENT

Executive Order 12038

February 3, 1978

Relating to Certain Functions Transferred to the Secretary of Energy
by the Department of Energy Organization Act

By virtue of the authority vested in me as President of the United States of America, in order to reflect the responsibilities of the Secretary of Energy for the performance of certain functions previously vested in other officers of the United States by direction of the President and subsequently transferred to the Secretary of Energy pursuant to the Department of Energy Organization Act (91 Stat. 565; 42 U.S.C. 7101 et seq.), it is hereby ordered as follows:

Section 1. Functions of the Federal Energy Administration. In accordance with the transfer of all functions vested by law in the Federal Energy Administration, or the Administrator thereof, to the Secretary of Energy pursuant to Section 301(a) of the Department of Energy Organization Act, hereinafter referred to as the Act, the Executive Orders and Proclamations referred to in this Section, which conferred authority or responsibility upon the Administrator of the Federal Energy Administration, are amended as follows:

- (a) Executive Order No. 11647, as amended, relating to Federal Regional Councils, is further amended by deleting "The Federal Energy Administration" in Section 1(a)(10) and substituting "The Department of Energy," and by deleting "The Deputy Administrator of the Federal Energy Administration" in Section 3(a)(10) and substituting "The Deputy Secretary of Energy."
- (b) Executive Order No. 11790 of June 25, 1974, relating to the Federal Energy Administration Act of 1974, is amended by deleting "Administrator of the Federal Energy Administration" and "Administrator" wherever they appear in Sections 1 through 6 and substituting "Secretary of Energy" and "Secretary," respectively, and by deleting Section 7 through 10.
- (c) Executive Order No. 11912, as amended, relating to energy policy and conservation, and Proclamation No. 3279, as amended, relating to imports of petroleum and petroleum products, are further amended by deleting "Administrator

of the Federal Energy Administration," "Federal Energy Administration," and "Administrator" (when used in reference to the Federal Energy Administration) wherever those terms appear and by substituting "Secretary of Energy," "Department of Energy," and "Secretary," respectively, and by deleting "and the Administrator of Energy Research and Development" in Section 1(b) of Executive Order No. 11912, as amended.

Section 2. Functions of the Federal Power Commission. In accordance with the transfer of functions vested in the Federal Power Commission to the Secretary of Energy pursuant to Section 301(b) of the Act, the Executive Orders referred to in this Section, which conferred authority or responsibility upon the Federal Power Commission, or Chairman thereof, are amended or modified as follows:

- (a) Executive Order No. 10485 of September 3, 1953, relating to certain facilities at the borders of the United States is amended by deleting Section 2 thereof, and by deleting "Federal Power Commission" and "Commission" wherever those terms appear in Sections 1, 3 and 4 of such Order and substituting for each "Secretary of Energy."
- (b) Executive Order No. 11969 of February 2, 1977, relating to the administration of the Emergency Natural Gas Act of 1977, is hereby amended by deleting the second sentence in Section 1, by deleting "the Secretary of the Interior, the Administrator of the Federal Energy Administration, other members of the Federal Power Commission and" in Section 2, and by deleting "Chairman of the Federal Power Commission" and "Chairman" wherever those terms appear and substituting therefor "Secretary of Energy" and "Secretary," respectively.
- (c) Paragraph (2) of Section 3 of Executive Order No. 11331, as amended, relating to the Pacific Northwest River Basins Commission, is hereby amended by deleting "from each of the following Federal departments and agencies" and substituting therefore "to be appointed by the head of each of the following Executive agencies," by deleting "Federal Power Commission" and substituting therefore "Department of Energy," and by deleting "such member to be appointed by the head of each department or independent agency he represents."

EXECUTIVE ORDER 10485

PROVIDING FOR THE PERFORMANCE OF CERTAIN FUNCTIONS
HERETOFORE PERFORMED BY THE PRESIDENT WITH
RESPECT TO ELECTRIC POWER AND NATURAL GAS FACILITIES
LOCATED ON THE BORDERS OF THE UNITED STATES

WHEREAS section 202(e) of the Federal Power Act, as amended, 49 Stat. 847 (16 U.S.C. 824a(e)), requires any person desiring to transmit any electric energy from the United States to a foreign country to obtain an order of the Federal Power Commission authorizing it to do so; and

WHEREAS section 3 of the Natural Gas Act, 52 Stat. 822 (15 U.S.C. 717b), requires any person desiring to export any natural gas from the United States to a foreign country or to import any natural gas from a foreign country to the United States to obtain an order from the Federal Power Commission authorizing it to do so; and

WHEREAS the proper conduct of the foreign relations of the United States requires that executive permission be obtained for the construction and maintenance at the borders of the United States of facilities for the exportation or importation of electric energy and natural gas; and

WHEREAS it is desirable to provide a systematic method in connection with the issuance and signing of permits for such purposes:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States and Commander in Chief of the armed forces of the United States, it is hereby ordered as follows:

Section 1.

(a) The Federal Power Commission is hereby designated and empowered to perform the following-described functions:

- (1) To receive all applications for permits for the construction, operation, maintenance, or connection, at the borders of the United States, of facilities for the transmission of electric energy between the United States and a foreign country.
- (2) To receive all applications for permits for the construction, operation, maintenance, or connection, at the borders of the United States, of facilities

for the exportation or importation of natural gas to or from a foreign country.

- (3) Upon finding the issuance of the permit to be consistent with the public interest, and, after obtaining the favorable recommendations of the Secretary of State and the Secretary of Defense thereon, to issue to the applicant, as appropriate, a permit for such construction, operation, maintenance, or connection. The Commission shall have the power to attach to the issuance of the permit and to the exercise of the rights grants thereunder such conditions as the public interest may in its judgment require.

- (b) In any case wherein the Federal Power Commission, the Secretary of State, and the Secretary of Defense cannot agree as to whether or not a permit should be issued, the Commission shall submit to the President for approval or disapproval the application for a permit with the respective views of the Commission, the Secretary of State and the Secretary of Defense.

Section 2. The Chairman or Acting Chairman of the Federal Power Commission is hereby designated and empowered to sign any permits issued by the Federal Power Commission pursuant to section 1(a)(3) hereof.

Section 3. The Federal Power Commission is authorized to issue such rules and regulations, and to prescribe such procedures, as it may from time to time deem necessary or desirable for the exercise of the authority delegated to it by this order.

Section 4. All Presidential Permits heretofore issued pursuant to Executive Order 8202 of July 13, 1939, and in force at the time of the issuance of this order, and all permits issued hereunder, shall remain in full force and effect until modified or revoked by the President or by the Federal Power Commission.

Section 5. Executive Order No. 8202 of July 13, 1939, is hereby revoked.

INTERCONNECTION AND COORDINATION OF FACILITIES;
EMERGENCIES: TRANSMISSION TO FOREIGN COUNTRIES

(AS AMENDED AUGUST 7, 1953)

FEDERAL POWER ACT
PART II
SECTION 202

(e) After six months from the date on which this Part takes effect, no person shall transmit any electric energy from the United States to a foreign country without first having secured an order of the Commission authorizing it to do so. The Commission shall issue such order upon application unless, after opportunity for hearing, it finds that the proposed transmission would impair the sufficiency of electric supply within the United States or would impede or tend to impede the coordination in the public interest of facilities subject to the jurisdiction of the Commission. The Commission may by its order grant such application in whole or in part, with such modifications and upon such terms and conditions as the Commission may find necessary or appropriate, and may from time to time, after opportunity for hearing and for good cause shown, make such supplemental orders in the premise as it may find necessary or appropriate. !49 Stat. 849; 16 U.S.C. 824a (e)1

(f) The ownership or operation of facilities for the transmission or sale at wholesale of electric energy which is (a) generated within a State and transmitted from that State across an international boundary and not thereafter transmitted into any other State, or (b) generated in a foreign country and transmitted across an international boundary into a State and not thereafter transmitted into any other State, shall not make a person a public utility subject to regulation as such under other provisions of this part. The State within which any such facilities are located may regulate any such transaction insofar as such State regulation does not conflict with the exercise of the Commission's powers under or relating to subsection 202(e). !67 Stat. 461; 16 U.S.C. 824a(f)1

APPENDIX C CANADIAN FEDERAL AUTHORIZATION PROCEDURES

- Statement of National Power Policy by Honourable Mitchell Sharp, October 8, 1963
- Canadian Authorization Procedures, July 17, 1978
- Federal Environmental Assessment and Review Process
- Lead Time for Applications to the Board, February 19, 1976

STATEMENT OF NATIONAL POWER POLICY

BY HONORABLE MITCHELL SHARP
MINISTER OF TRADE AND COMMERCE

OCTOBER 8, 1963

I wish today to announce, on behalf of the Government, a national power policy. I do not think that I have to emphasize the vital role the power industry is playing and must continue to play in the development of our nation.

The story of the electric power industry of today is one of constant evolution as it strives successfully to reduce costs. Canada must provide the climate in which we can take advantage of these technical breakthroughs. Our policy places particular emphasis on:

- (a) the desirability of Canada to take fullest advantage of the evolutionary changes that have taken place in the nature of the power industry, including technological improvements in generating and transmission facilities, and the reduced costs of power associated with these;
- (b) the provision of abundant supplies of electrical energy to consumers throughout Canada at the lowest possible cost to encourage and accelerate economic development and growth;
- (c) the need for Canada to have a flexible export policy which, inter alia, would permit the export of large blocks of power to the United States for a relatively long period of years to assist in the immediate development of certain large-scale Canadian power projects, particularly undeveloped hydro resources which might not be viable in the near future unless provisions were made for the marketing in the United States of a significant portion of their output; and
- (d) the strengthening of our balance of payments position through the export of power surplus to our own needs.

The policy now being announced reflects important changes which have taken place in the circumstances affecting export of power. The Government is fully aware of the body of public opinion that has been opposed to export of power, in the first instance because of events which occurred over 50 years ago.

The National Energy Board Act now provides that all exports of power must be licensed by the National Energy Board with the approval of the Governor in Council. Licences may not be issued for a term in excess of 25 years. The National Energy Board is required to certify that the power to be exported does not exceed the surplus remaining after due allowance has been made for the reasonably foreseeable requirements for use in Canada--this has been interpreted to mean surplus to Canadian requirements which can be supplied economically from the generating facilities producing the power for export.

Further, the Board must satisfy itself that the export price of the power is just and reasonable in relation to the public interest.

From 1907 until the coming into force in 1959 of the National Energy Board Act, the export of power was subject to licence under the Exportation of Power and Fluids and Importation of Gas Act. By regulation under that Act, the term of a licence was limited to one year. This was intended to prevent permanent alienation of Canadian power capacity which, though surplus when installed, would be required in Canada as time went on. It was realized that, if an industry or a community in the United States became dependent on a Canadian power supply, it would be difficult, if not impossible, to withdraw that supply.

Such difficulties as have occurred in respect of the recapture of power exports arose, in part, because over 50 years ago long term contracts (up to 85 years) were made by Canadian power producers with specific industries in the United States. The contracts contained no provisions for the repatriation of the power. The Canadian supplier, in effect, had taken on within the United States the responsibility of a public utility to maintain continuity of supply for its customers. As a result, the protection of the one year limitation on licences was illusory.

The nature of the power industry today is very different from what it was in 1907 and in most of the intervening years. It is now unusual for the capacity of a large, modern electric plant to be dedicated to a single industry or for a large utility to be dependent on one source of power supply. We are entering the era of large private and public electrical utilities, interlinked with high voltage lines, and operated pursuant to interconnection agreements designed to take advantage of the new technological improvements and the economies of scale.

A public utility, whether in Canada or the United States, now takes it as a matter of course that it must contract for or install capacity to replace a portion of its total power supply, when the contract covering that portion runs out. The old aphorism that an

export sale, once established, cannot be terminated without hardship in the export market and danger of international friction, is no longer valid if the export contract is made with a public utility in the United States under reasonable terms and conditions.

When the National Energy Board Act came into effect in 1959, power export licences which had been issued under the Exportation of Power and Fluids and Importation of Gas Act were continued in effect for some time, so that the Board might apply to each case (with minor exceptions) the procedure of application, public hearing, detailed analysis and recommendation to the Governor in Council.

In 1959, actual total exports, as distinguished from licensed authorizations, were 4.582 million kilowatt hours. In 1962, export had declined to 80 percent of the 1959 total.

In 1962, Canada produced 117 billion kilowatt hours, including 11.4 percent from thermoelectric plants. Of the total production, only 0.47 percent was exported as firm energy and 2.8 percent as interruptible energy. Of the latter, 86 percent was interchanged with United States utilities, having been returned to Canada at the same time over other circuits, or over the same circuits at other times.

In the light of the circumstances I have outlined, the Government has decided to develop and carry forward effective policies embracing two essential concepts:

first, encouraging development of large low-cost power sources and the distribution of the benefits thereof as widely as possible through interconnection between power systems within Canada; second, encouraging power exports and interconnections between Canadian and United States power systems where such induce early development of Canadian power resources.

More specifically, our policy is as follows:

The Government, having due regard to the rights of the provinces with respect to the development and distribution of power and keeping in mind its own responsibilities in this field, desires to encourage interconnection agreements and maximum utilization of intertie facilities between electrical systems, both publicly- and privately-owned.

The Government, in cooperation with the provinces, has already undertaken studies to investigate the possibility of interconnecting power systems across the country. It realizes that the complete interconnection may not be economically feasible for some years to

come. Nevertheless, it would appear that by establishment of interconnection facilities between utilities in adjacent regions wherever practical, a national system might be developed by a succession of stages, each valuable in itself.

The Government believes that it would be beneficial to Canada and to the United States, and not prejudicial to the national interest to encourage interconnection agreements and interties between utilities in the respective countries in cases where the interconnection agreements suitably protect the Canadian interest.

In cases in which Canadian utilities enter into appropriate interconnection agreements with United States utilities, the Government will be prepared, upon recommendation of the National Energy Board, to give favorable consideration to the authorization of export of power to United States utilities for purposes including the following:

- (a) to provide standby service in the case of emergencies; thus making possible the reduction of reserve generating capacity otherwise required by the utilities;
- (b) to provide for economy flows between plants or systems;
- (c) to provide for sales of surplus interruptible energy;
- (d) to provide for exchange of power and energy to take advantage of load, watershed or other diversities;
- (e) to provide for exports of firm power for limited periods to make possible the step by step construction of the most economical generating facilities on either side of the boundary.

The Government also believes that it would be in the national interest, in suitable cases, to license the export of large blocks of firm power to United States utilities to permit the development of large-scale remote hydro or other power projects which would not be viable unless supported by the export for long periods of a significant proportion of the power generated. The National Energy Board Act permits such exports for periods of up to 25 years. Provision would have to be made for the recapture of such exported power over a period of years, in stages commensurate with the need or ability of the Canadian market to absorb it, and upon notice adequate to enable the importing utility to arrange for replacements. The provisions of the National Energy Board Act would, of course, apply to any case of this nature, as to any export of power.

The Government will, upon recommendation of the National Energy

Board, continue to authorize the export of relatively small amounts of power and energy to border areas in the United States where, for geographical reasons, Canada is the economic source of supply.

JOINT UNITED STATES/CANADA
ELECTRIC POWER INTERCHANGE STUDY

CANADIAN AUTHORIZATION PROCEDURES

JULY 17, 1978

In Canada regulatory authority over exports of electricity and the construction and operation of international power lines is exercised by the National Energy Board, an agency of the Federal Government. An application to the Board, whether for a certificate to construct an international line or for a licence to export power, requires a public hearing. At the hearing, interested parties may present evidence and arguments for or against the application. The hearing is normally held before a panel of three Board Members. Their decision is handed down subsequently as a report which describes the application, summarizes the evidence, states the decision, gives the reasons for it, and sets out the conditions to be included in any certificate or export licence to be granted.

A decision by the Board to grant a certificate or licence is not effective until it receives the approval of the Governor General in Council. (In Canada the Governor General represents the Queen as Head of State.) This official government approval, however, is not required if the Board decides to reject the application.

The Board may dispense with a public hearing in cases where an international power line would be of very low capacity -- less than 5 megawatts, or where the export would be small -- less than 4 megawatts or 20 gigawatt-hours of energy per year. In these cases, government approval of a Board decision is not required.

The Board may also authorize exports without a public hearing and without government approval if emergency conditions have arisen that may cause interruptions in the supply of power to consumers in the United States served by facilities interconnected with Canadian systems.

In examining applications for export licences, the Board divides proposed exports into two broad classifications: firm power and interruptible energy. Firm power is power intended to be available at all times specified by an agreement. Interruptible energy is energy that may be interrupted or curtailed at the option of the supplier. It is obvious that an application for the export of firm power warrants a more comprehensive examination than one for the export of interruptible energy.

The National Energy Board Act requires the Board, in considering an application, to satisfy itself that the quantity of energy to be exported is surplus to reasonably foreseeable Canadian requirements, and that the price to be charged is just and reasonable in relation to the public interest. In addition, the Board is required to consider all matters that appear to it to be relevant.

To ensure that an export price is just and reasonable, the Board has developed three criteria that the price must meet. Firstly, it must cover fully the cost of the energy to be exported. Secondly, it must not be less than the price to Canadians for comparable service. Thirdly, it should not be materially less than the least-cost alternative available to the U.S. purchaser.

The clause in the Act requiring the Board to consider all matters that appear to it to be relevant provides wide powers of enquiry. It enables the Board to scrutinize every aspect of an export application. It is interpreted as embracing such matters as economic effects, employment opportunities, balance of payments, and the environmental impact of producing the power for export.

The Act limits export licences to a maximum term of 25 years. Most licences, however, are issued for a term of 5 to 10 years.

The Board usually issues separate licences for interruptible energy, firm power, short term firm power and wheeled power. Licences for exports over major system interconnections traditionally allow the exporting utility fairly wide latitude to arrange individual transactions. The licence sets maximum limits, usually per year or per consecutive 12 months, and prescribes minimum prices or pricing formulae. The licensee is then free to negotiate transactions within these limits and subject to the general conditions of interconnection-type agreements filed at the hearing. Any amendments to such agreements or to the prices during the term of a licence are subject to the approval of the Board through the mechanism of an interim filing. Certain classes of short term firm power sales under an export licence are also subject to individual approval when negotiated.

No licence is required to import power into Canada.

In considering an application for certification of an international power line, the Board examines the availability of power for the line, the existence of markets, the economic feasibility of the line, its general financing, and any public interest that may be involved. Since July 1974, every applicant for a certificate is required to provide an assessment of the environmental impact of the facility for which authorization is requested.

FEDERAL ENVIRONMENTAL ASSESSMENT

AND REVIEW PROCESS

One of the first concerns of the Department of the Environment after it was formed was to examine the Federal Government's role as a polluter and make certain that Federal projects were assessed and suitable remedial measures taken where required to prevent or abate such pollution. The Federal Cabinet in June 1972 accepted a departmental proposal that all new projects initiated by the Federal Government be screened for this purpose, and directed that those requiring further assessment be referred to the Department of the Environment.

Although pollution is a major component of the environmental spectrum, it does not cover all the environmental aspects associated with Federal activities. Many other considerations, such as the impact of physical impediments on aquatic life and wildlife migration routes, or the indiscriminate use of nonrenewable resources including land must be taken into account.

On December 20, 1973, Cabinet decided to establish an Environmental Assessment and Review Process to ensure that:

- (a) environmental effects are taken into account early in the planning of new Federal projects, programs and activities;
- (b) an environmental assessment is carried out for all projects which may have an adverse effect on the environment before commitments or irrevocable decisions are made; projects with potentially significant environmental effects are submitted to the Department of the Environment for review;
- (c) the results of these assessments are used in planning, decision-making and implementation.

Federal projects are considered to be those that are initiated by Federal departments and agencies; those for which Federal funds are solicited and those involving Federal property. This definition covers those projects that may originate outside the Federal Government but involve a particular Federal department through funding or property considerations. In such cases, the Federal department sponsoring the project is responsible for the environmental assessment. All Federal organizations are bound by the Cabinet decision except proprietary crown corporations and regulatory agencies which are invited, rather than directed, to participate in the process.

As early in the planning phase as possible, a department screens projects and activities for which it is responsible to identify potential adverse environmental effects. The Department of Fisheries and the Environment has developed screening guidelines to help Federal departments and agencies with this task. They were designed in matrix form to provide the user with a quick method of identifying the relationships between a broad range of human activities and the environmental elements involved with projects in general.

As a result of this initial screening of a project by the department or agency concerned, one of the following three decisions is possible:

- (1) There are (a) no anticipated adverse environmental effects associated with the project or (b) the anticipated environmental effects are known and are not considered significant.
- (2) The nature and scope of potential environmental effects cannot be readily determined during preliminary screening.
- (3) The anticipated adverse environmental effects are considered to be significant and the project requires a formal environmental review by the Department of Fisheries and the Environment.

If decision 1 is made, the department concerned is responsible for implementing measures required to prevent or mitigate the environmental effects identified, and satisfying all other legislative, regulatory and Cabinet requirements related to the development and implementation of the project. However, no further reference to the Environmental Assessment and Review Process is required.

THE INITIAL ENVIRONMENTAL EVALUATION (I.E.E.)

If a department is unable to identify the full environmental consequences and their significance through the screening procedure as indicated in decision 2 above, then the project is subjected to a more searching examination called the Initial Environmental Evaluation (I.E.E.). The I.E.E. provides a description of the project, of the existing environment and resource use; of potential environmental effects and impacts; of measures proposed to mitigate or prevent certain anticipated environmental effects; and a judgment concerning the impact of those effects that remain after all known measures for prevention and counteraction have been specified. In this description, the alternate ways of accomplishing the project are examined and the preferred alternative(s) identified.

Based on the review of the I.E.E., the department concerned then decides whether the proposed project involves significant environmental effects or not. If the effects are not considered significant, the department is responsible for implementing appropriate measures for environmental protection that have been specified, but no further reference to the Process is required, as in screening decision 1 above. However, if the anticipated effects are judged to be significant, the department then submits the project to the Department of Fisheries and the Environment for a formal review as in screening decision 3.

It should be noted that a department is only obliged to prepare an I.E.E. when it is unable to identify the nature of potential environmental effects during preliminary screening. No I.E.E. is required under Process procedures when screening decisions 1 and 3 are made.

Departments and agencies are encouraged to seek environmental advice from the Department of Fisheries and the Environment during the screening procedure and in the development and review of I.E.E.'s. The Department has established Regional Screening and Coordinating Committees in each of its five regions to facilitate this advisory service. In addition, consultants outside the Federal Government could be used for this purpose. Known public concerns about specific projects constitute another important input to departments in making their environmental decisions.

In summary, the prime concern during the screening and I.E.E. phase of the Process for project alternatives under consideration, is to:

- (a) specify preventive and mitigating measures for anticipated environmental effects that have been identified and are amenable to such measures. These measures would be incorporated when a project is implemented;
- (b) identify anticipated effects which are "left over" after all known remedial measures have been specified and which may have significant impacts on the environment.

If the department involved considers these residual effects to be significant, it then requests the Department of Fisheries and the Environment to proceed with a formal review of the project by an Environmental Assessment Panel.

THE ENVIRONMENTAL ASSESSMENT PANEL

An Environmental Assessment Panel is a small body of experts (usually 4 to 6) formed to review the environmental consequences of a

specific project and its alternatives, and to evaluate the significance of the environmental impacts that might result from implementing the project.

A permanent Panel Chairman has been appointed by the Department of Fisheries and the Environment to administer Process procedures, particularly the operation of panels. He (or his delegate) chairs all panels established to review projects, and he reports to the Minister of Fisheries and the Environment on the recommendations made by panels. A project submitted for panel review may not be carried out until a decision has been reached on panel recommendations.

THE ENVIRONMENTAL IMPACT STATEMENT

When the Environmental Assessment Panel is formed to assess a project, one of its first tasks is to develop specific guidelines for the preparation of an Environmental Impact Statement (E.I.S.). The E.I.S. is a detailed documented assessment of the environmental consequences associated with the project, and is prepared, or procured through consultants by the department responsible for the project. It must be prepared in accordance with the guidelines issued by the Panel. The nature of the project and its proposed location will determine in many respects the type of detailed information required. The impact on people due to noise and land use would be prime considerations when assessing a proposal for a new airport. The potential for damage from radiation would be an important factor when a proposed nuclear power generating station is under review.

THE PROCESS AND THE PUBLIC

After receiving the Environmental Impact Statement, the Panel's next step is to obtain public reaction to the project. Both the guidelines issued by the Panel and the Environmental Impact Statement prepared by the Federal agency initiating or sponsoring the project are made available to those interested before any formal meetings for public discussion are held. After this information has been issued, the Panel arranges to meet the public and receive briefs (oral and written) from individuals and groups who wish to present their viewpoints. Generally, these meetings will be held in the particular area proposed for the location of the project.

The Federal assessment process attaches great importance to anticipated public concerns in determining the "significance" of potential adverse environmental effects. On the other hand, a Panel established to make such judgments must weigh the extent of such reaction

and its validity in terms of the scientific and technical factors involved when making its recommendations. In unusual cases, the ministers involved may decide that it is advisable not to release information on a project.

THE DECISION

When a Panel has reviewed the Environmental Impact Statement, the public response, and any other information it feels is required, it prepares a report for the Minister of Fisheries and the Environment. This report contains the history of events associated with the project, a detailed examination of the vital environmental factors involved including their major impacts on the social and economic sectors, and recommendations concerning project implementation. A Panel could recommend that a project be halted, that it proceed as planned, or that it proceed with certain qualifying conditions and terms. These terms might include environmental requirements for project design, and the development of certain studies to obtain needed information. They might also include requirements for surveillance during construction and operation of the project to evaluate the performance of environmental protection measures used, and monitoring the actual environmental impacts for comparison with predicted impacts.

The Panel report is then submitted to the Minister of Fisheries and the Environment through the Chairman, and the Minister must decide whether to accept the recommendations or not. He must also decide whether the report should be made public. These decisions are made in consultation with the minister of the department initiating the project. If they agree to accept the recommendations made by the Panel, the report is released to the public and the initiating department is instructed to implement the recommendations. This ministerial decision would also identify the Federal agencies responsible for any surveillance and monitoring needed.

There is the possibility of disagreement between the two ministers on the course of action that should be taken. In this case the matter would probably be referred to Cabinet for resolution. Regardless of the circumstances involved, the Minister of Fisheries and the Environment may release the report to the public if he believes the situation warrants this step.

File No. L1064-2
19 February 1976

To all Electrical Licensees
of the National Energy Board

Dear Sirs:

Re: Lead Time for Applications to the Board

The National Energy Board has recently completed an analysis of past electric power applications which resulted in public hearings being held. This was done with a view to establishing just how long it takes from the date of application to the date of any approval by the Governor in Council.

The Board's analysis shows that major applications require a period of up to twelve months. Furthermore, this period assumes that items which are beyond the Board's control, such as responses to deficiency letters, amendments to the application, interventions or appeals, do not cause lengthy delays.

This information should prove valuable because an applicant may be faced with deadlines due to contractual arrangements to begin new exports, or the imminent expiry of an existing licence, or the required in-service date of a new international power line. Under Section 40 of the NEB Act, no person may start the construction of an international power line until the Board has issued an authorizing certificate.

To avoid the possibility of a decision not being available by the desired date, therefore, the Board strongly recommends that future applications for power export licences or certificates of public convenience and necessity be submitted at least twelve months before that date. This period will allow for the orderly processing of applications.

Yours truly,

Brian H. Whittle
Acting Secretary

GIS/GHi/ct

c.c.: Board Members
Electrical Engineering Branch

APPENDIX D

REGIONAL REPORTS

1250 BROADWAY / NEW YORK, N.Y. 10001
TELEPHONE: 212/868-1400

MEMBERS

BOSTON EDISON COMPANY
BURLINGTON ELECTRIC
DEPARTMENT
CENTRAL HUDSON GAS & ELECTRIC
CORPORATION
CENTRAL MAINE POWER COMPANY
CENTRAL VERMONT PUBLIC SERVICE
CORPORATION
CONSOLIDATED EDISON COMPANY
OF NEW YORK, INC.

EASTERN UTILITIES ASSOCIATES
GREEN MOUNTAIN POWER
CORPORATION
LONG ISLAND LIGHTING COMPANY
NEW BRUNSWICK ELECTRIC
POWER COMMISSION, THE
NEW ENGLAND ELECTRIC SYSTEM
NEW ENGLAND GAS AND ELECTRIC
ASSOCIATION
NEW YORK STATE ELECTRIC & GAS
CORPORATION

NIAGARA MOHAWK POWER
CORPORATION
NORTHEAST UTILITIES
ONTARIO HYDRO
ORANGE AND ROCKLAND
UTILITIES, INC.
POWER AUTHORITY OF THE STATE
OF NEW YORK
PUBLIC SERVICE COMPANY OF
NEW HAMPSHIRE
ROCHESTER GAS AND ELECTRIC
CORPORATION
UNITED ILLUMINATING
COMPANY, THE

December 22, 1978

Dr. Charles A. Falcone
Director, Division of Power Supply and Reliability
Economic Regulatory Administration
Department of Energy
Room 4072 - Vanguard Building
2000 M Street N. W.
Washington, D. C. 20036

RE: US/CANADA INTERCHANGE STUDY

Dear Charlie:

For the New England and New York representatives to the subject study group, attached is one copy each of the following reports:

- Report on United States/Canada Electric Power Exchange Study for New York-ECAR-Ontario, prepared jointly by: R. R. Schneider, Niagara Mohawk Power Corp., New York; J. F. Aldrich, Niagara Mohawk Power Corp., New York; B. H. Schneider, Detroit Edison Co., Michigan; H. R. Williams, Detroit Edison Co., Michigan; H. P. Smith, Ontario Hydro, Ontario; W. H. Winter, Ontario Hydro, Ontario.
- Report on United States/Canada Electric Power Exchange Study for New England-New Brunswick, prepared jointly by: C. E. Monty, Central Maine Power Company, Maine, New England; W. T. Schultheis, Northeast Utilities Service Co., Connecticut, New England; F. C. MacLoon, New Brunswick Electric Power Commission, New Brunswick.

These reports cover information pertaining to terms of reference 1 through 6 which include: Interconnection in service, capacity and transfer capability; plans for additional interconnections; generic types of transactions; magnitude of the transactions; identify reasons why transactions are not greater; and, identify specific opportunities for increased electricity imports and exports.

Kindest regards.

Sincerely yours,

Julius Bleiweis
Julius Bleiweis
Executive Director

JB:LG
Attachment

**Detroit
Edison**

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December 18, 1978

Mr. C. A. Falcone
Director of Power Supply
and Reliability
Economic Regulatory
Administration
Department of Energy
Washington, D.C. 20461

Dear Mr. Falcone:

East Central Area Reliability Coordination Agreement (ECAR), part of (New York) Northeast Power Coordinating Council (NPCC) and Ontario Hydro which is also part of NPCC have carried out a study of United States/Canada Electrical Power Exchange. It is a regional study relating primarily to the Ontario Hydro System in Canada and those systems in ECAR and NPCC in the United States. Enclosed is the regional Report of that study.

The people involved in this Report preparation are:

The Detroit Edison Company - for ECAR

B. H. Schneider, Assistant Vice President-Planning
and Research
H. R. Williams, Director-Planning Department

Niagara Mohawk Power Corporation - for part of NPCC

R. R. Schneider, Vice President of Electric Production
J. P. Aldrich, Manager of System Power Control

Ontario Hydro - for Ontario

W. H. Winter, Director-Power System Operations
H. P. Smith, Staff Director

Mr. C. A. Falcone
December 18, 1978
Page 2

The Terms of Reference for this study are included as Attachment 1 to this Report. Information on the first six items of the Terms of Reference are contained in Sections of this Report with corresponding numbers. This includes a list of existing and planned interconnection facilities, data on types and magnitudes of present electricity exchanges, the identification of obstacles limiting present exchanges and the identification of opportunities for greater exchanges in the future. In addition to the above noted six items, this Report includes notes on legislation and regulatory procedures in Ontario and Michigan as Appendices I and II.

Yours truly,

Burkhard H. Schneider /HRS/

Burkhard H. Schneider - for ECAR

BHS/tt

Enclosure

cc: O. A. Lentz, Executive Manager-ECAR
R. R. Schneider
J. P. Aldrich
W. H. Winter
H. P. Smith
J. R. White, Chairman-ECAR Executive Board
H. R. Williams

REPORT ON

UNITED STATES/CANADA

ELECTRIC POWER EXCHANGE STUDY

NEW ENGLAND - NEW BRUNSWICK

DECEMBER 1978

Prepared jointly by:

Mr. C. E. Monty - Central Maine Power Company, Maine - New England

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Mr. C. F. MacLoon - New Brunswick Electric Power Commission - New Brunswick

OPPORTUNITIES FOR EXPANDED CANADA-US. ELECTRICITY EXCHANGE
NEW ENGLAND/MARITIMES RESPONSE TO TERMS OF REF. NO. 1 THROUGH NO. 6

NEW ENGLAND/MARITIME REGION ELECTRICAL INTERCONNECTIONS

Interconnections between service areas in Maine and New Brunswick have existed for most of the history of the electric utility industry. A major strengthening occurred in 1970 when the 345 kV line between Wiscasset, Maine and Keswick, New Brunswick was placed in service, synchronizing the New Brunswick and Nova Scotia systems with the New England systems.

Table 1-A lists the 1978 New Brunswick (Canada) - Maine (U.S.A.) significant Interconnected Transmission lines.

The service areas of Eastern Maine Electric Cooperative Inc. and Maine Public Service Company are radial to the NB Power system, having no direct interconnection with utilities in New England. Joint planning occurs for the development of bulk power transmission in the adjacent service areas of these New Brunswick and Maine systems.

PLANS FOR ADDITIONAL INTERCONNECTION CAPACITY

Authorization has been received for the uprating in 1979 to 138 kV from 69 kV of the line between Flo's Inn in the Maine Public Service Company area and Beechwood, New Brunswick. This uprating will increase the transfer capability by some 40 MW.

GENERIC TYPES OF INTERNATIONAL ELECTRIC
INTERCHANGE TRANSACTIONS BETWEEN
THE NEW ENGLAND AND MARITIME REGIONS

These transactions are defined in Table 2 and include Firm Power, Unit Power, Emergency Power, Economy Energy, and Other.

Interconnection Agreements and Contracts for these transactions are developed and entered upon by the utilities concerned. These contracts and undertakings are then filed with the appropriate regulatory agency for approval.

MAGNITUDE OF TRANSACTIONS

Table 1-B summarizes the transactions between New England and New Brunswick for the years 1973 to 1977 inclusive.

IDENTIFY REASONS AND OBSTACLES WHY TRANSACTIONS ARE NOT GREATER AND OTHER TYPES ARE NOT EMPLOYED

General

Opportunities for increased transactions between the two countries are, of course, dependent on a requirement existing along with an economic and surplus supply to meet that requirement.

There is a continuing and a relatively high level of activity between the two countries in this region. The transactions have been of relatively short term ranging from the 10 year term of the unit power export agreement related to New Brunswick's Coleson Cove Thermal plant down to the hour by hour agreements characteristic of the on-going economic interchanges.

An exception to this has been the 25 year term by which the output of the 36 MW Tinker Hydro Plant located in Canada has been licensed for export to its U.S. parent, the Maine Public Service Company.

The issues to be covered can be considered separately for short-term and long-term arrangements. For purposes of this discussion, "short-term" includes hourly economy interchange, emergency deliveries, seasonal diversity exchange, and sales of surplus energy available as the result of generating capacity additions not precisely following need, but not contemplated by either buyer or seller as other than temporary in nature. Long-term transactions imply a duration of from 10-50 years and constitute those arrangements factored into and made an integral part of the long-term expansion plans of the systems involved.

There are no immediate requirements on the Canadian side for imports of power, beyond the normal economy exchanges, from the U.S. and there presently appears to be only limited opportunities for Canadian exports at least until the mid to late 1980's based on presently committed U.S. developments.

Aside from the normal requirements that there must be an economic supply to meet a given requirement, the obstacles to increased transfers lie largely in the timing delays, and uncertainties of the regulatory and of the environmental review and "property use" processes. Other obstacles also can be identified.

Transfers from Canada to the U.S.

Specific areas of concern are as follows:

Regulatory

Canadian exports are regulated by the National Energy Board. The Government of the Province of N.B. has jurisdiction over environmental assessment procedures for projects.

While the National Energy Board has administered the regulations with respect to electricity exports in a consistent and reasonable manner

there are several problems that develop from the ACT and its regulations which tend to discourage longer term and more consequential transactions. These are as follows:

- (1) The provision of the N.E.B. licensing whereby the export can be interrupted for reasons of "National interest" introduce a measure of uncertainty that reduces the reliance a U.S. purchaser can place on a Canadian supply to meet firm power requirements. As a result, it is difficult for a U.S. utility to modify generation development on the basis of a desire to take advantage of a Canadian supply.
- (2) The provisions of the N.E.B. Act are widely interpreted to require assurance that the price paid by the U.S. utility is not significantly below the alternate cost available to it through development of other sources. An understanding has developed of this requirement that has led to a feeling that no significant saving can thereby be achieved and thus proposals for development in the U.S.A. should be favored over external purchases when there is a clear alternative.
- (3) The time period involved between an initial application and the final licensing, along with the uncertainties of the final outcome, make it difficult to undertake major capital facilities with a major export involvement when opportunities do appear.
- (4) The desire to limit the length of time over which exports can be licensed goes against the justification that can be developed for major transmission additions which normally require long term write-off. A proposal to purchase power available from a new generating facility for a period less than its estimated useful life may appear less desirable to a prospective buyer than installing its own facilities because such generating capacity will have to be replaced by the buyer at the end of the contract period. Such replacement would presumably be at a higher cost than such capacity could be installed today. The prospective buyer would have the use of generation installed on its system for its full useful life at its lower cost. The desirability of a purchase is further decreased if the proposal includes the pricing practice described in item (2) immediately above, because under such circumstances all advantages accrue to the benefit of the seller.

The problem is one of lengthy timing, uncertainties of approval and the length and security of power supply licensing available.

There is also a requirement for licensing of transmission lines at points of crossing over navigable rivers in accordance with the requirements of the Canadian Navigable Waters Act. This requires submissions to, and approval by, the appropriate Federal Agency.

Environment

Transmission and generation development are subject to environmental review by Provincial Governments and the transmission over which power is to be exported is also subject to National Energy Board consideration.

Experience in New Brunswick has been that careful consideration of location, minimizing environmental effects and observance of established procedures of assessment and approval avoids any real problem with the regulatory process. Public perceptions do not, at this stage, force unreasonable delays in the approval process.

Details of procedures are set out in Appendix A attached.

Financial

Financial limitations can obviously make it difficult to develop a high capital cost project which might be highly attractive as a source of power for both domestic and export markets.

Financial limitations also arise in the sense of inability to justify major transmission interconnection additions through the generally limited terms of licensing and through the short period in which surpluses are often available for export.

Economic justification, and financial investment required, both become difficult due to the limited period of clearly definable use. Justification then becomes dependent on longer term, and less definable benefits.

Political

The successful undertaking of the facilities required for a major international transaction depend, to a significant extent, on avoiding major public opposition.

While it is not suggested that coordinated international political co-operation should attempt to overcome such opposition it seems clear that opposition is less likely to develop where such cooperation is in evidence and supported by public leaders.

Transfer from the U.S. to Canada

The obstacles to increased short-term sales by the U.S. to Canada in the next 10 years are primarily economic in nature.

New England and the Maritime Provinces are each currently in a surplus capacity position. Whether or not New England remains in this position beyond the mid-1980's is largely dependent upon whether or not New England can complete its nuclear expansion program contemplated for that period. For purposes of this discussion we assume that New England has a surplus available.

What is the nature of New England's surplus? Such surplus is principally in oil-fired intermediate range and peaking steam generation. New Brunswick is also surplus in oil-fired steam generation. It is not anticipated that any significant sales will be made by New England to New Brunswick in the near term primarily because there will be no economic advantage and further because such sales would increase U.S. dependence on foreign oil.

We do not consider the existing U.S. regulatory procedures as a bar to the sales of short-term surplus power. Public acceptance and state regulatory attitudes are not perceived as an impediment to short-term sales using existing facilities since there would be a perception of economic benefit to New England consumers.

Existing transmission facilities would appear adequate for short-term sales to New Brunswick at a realistic level. Reliability considerations on the part of New Brunswick would tend to limit the amount of dependence they would place on the single interconnection. The establishment of additional transmission facilities to permit export to Canada would raise similar questions with respect to such facilities as is discussed under the section on long-term arrangements which follows. In addition, the economic justification of installing long-lived transmission facilities to accommodate short-term transfers is much more difficult to document. The second or third interconnecting line to the same area must be justified on the economics of energy transfers which are expected to take place over its full life since there is only a small proportion of the cost of an additional interconnection which can be justified on the basis of improved reliability.

For purposes of long-term sales, it is assumed that the concept is one of installing generating facilities in New England with all or part of such facilities dedicated to the supply of electric energy to the Maritime Provinces on a reasonable long-term basis (i.e., 20 years for example). A wide variety of obstacles exist to the accomplishment of such an arrangement.

A) Regulatory - State Level

1. Although the specifics vary from state to state, a requirement exists for state regulatory approval for the construction of new generating facilities. In general such regulatory agencies are obligated to consider such issues as need for power, environmental impact, economics, alternative technologies and sites, etc. It is entirely reasonable to anticipate that state regulatory approval would not be forthcoming in the absence of significant economic advantage to the citizens of the state, coupled with general public acceptance and associated political support. Such support is viewed by many as questionable.
2. In addition to state regulatory approvals for generation construction, state regulatory approval is required for transmission line construction. In some states multiple agency approvals are required. Since in many cases associated transmission lines would traverse several states, the approval process is further complicated. The same comments with respect to economics, public and political acceptance made earlier with respect to generation hold equally true for transmission. A summary of the Maine regulatory process for siting transmission lines is attached as Appendix B.

B) Regulatory - Federal Level

An export license from ERA and FERC approval of the sales and transmission contracts are required. The former would likely require the

development of a NEPA environmental impact statement. This obviously adds another layer of regulatory review and another uncertainty to the permitting process.

C) Environmental and Land Use

Most of the environmental and land use obstacles fall under the regulatory process since that is the forum where environmental impacts will be assessed. In its simplest terms, the controlling environmental factor is the willingness of the public in one area (New England) to dedicate and use its environmental resources for the benefit of another area, be it elsewhere in the U.S. or in Canada.

If the construction of coal-fired plants in the U.S. were to be considered as likely power sources for export to Canada, then consideration would have to be given to air quality regulations and in particular whether or not the installation of a coal-fired power plant would "use up" some of the air quality "margin" and thereby inhibit future economic growth of that region.

D) Financial

The high cost of new generating facilities and their long lead time is currently placing a great financial strain on most investor-owned utilities in the U.S. The ability of such firms to raise capital to build transmission and generating facilities for sales to other than their regular customers is accordingly seriously limited.

E) Economic

The present planning and system expansion of U.S. utilities is greatly hampered by the uncertainties created by the multiplicity of regulatory approvals required. Financial risks are increased because significant financial commitments must be made prior to receipt of final required regulatory approvals. The additional exposure to regulatory review and intervention in projects to supply power outside the U.S. and the corresponding increase in the time between commitment and project completion, together with an increase in financial risk and power supply uncertainty, all combine to make participation of Canadian utilities in U.S. projects unattractive in the absence of truly compelling economic advantages.

IDENTIFY SPECIFIC OPPORTUNITIES IN EACH COUNTRY FOR INCREASED IMPORTS AND EXPORTS AND LIST OBSTACLES

In New England three generating technologies are judged to offer possible opportunities for joint use development. In each case, the economic justification would flow primarily from the ability to take advantage of the economies of scale associated with large projects which would be more practical in New England, given its larger system size and interconnections with the rest of the U.S. These technologies are as follows:

- . Base load coal units in the 800-1200 MW size
- . Nuclear units in the 1150 MW size
- . Pumped storage hydro plants in the 1500-2000 MW range (possible use in firming up tidal power)

In the Canadian region, the opportunities relate to projects now under way -- those which might be undertaken and sources of surplus supply which may become available from developments external to the region.

Specific opportunities would be:

- . Short-term surplus sales during the early years of project service from large nuclear units now in construction as was undertaken in the case of the oil-fired Coleson Cove Thermal Plant.
- . Advanced development of large nuclear or coal-fired additions to provide surplus for export.
- . Surplus energy from existing generation developments and from possible tidal development should such be undertaken.
- . Surplus power from major developments which might be undertaken in other regions which are interconnected with New Brunswick.
- . Surplus peaking capacity from run-of-the-river hydro plants which are dependent on load growth to develop full peaking capability and thus have early year surpluses of such capacity.

The obstacles discussed in the response to question 5 are equally applicable to the above. It should also be noted that, in addition to the direct "across the border" transmission interconnection facilities which would be required to permit substantial increases in power transfers, significant internal transmission reinforcement would also be necessary.

TABLE 1-A

SIGNIFICANT INTERCONNECTED TRANSMISSION LINES: MAINE - NEW BRUNSWICK

<u>U. S. STATE</u>	<u>CANADIAN PROVINCE</u>	<u>LOCATION OF CROSSING</u>	<u>NUMBER OF CIRCUITS</u>	<u>VOLTAGE KV</u>	<u>FACILITY RATING (NOMINAL) MW</u>	<u>IMPORT TRANSFER CAPABILITY IN MW (Nonsimultaneous, incremental - all lines in service with ability to lose one line)</u>
<u>New England</u>						
Maine (see note)	New Brunswick	Orient	1	345	600	0-600

NOTE: Five 69 KV interconnections between Maine Public Service (MPS) and New Brunswick (MPS isolated from NEPEX) with a capacity of 60/75 MW (60 MW with one line out). These lines will be modified in 1979, one 138 KV and four 69 KV with a capacity of 60/100 MW.

TABLE 1-B

GENERIC TYPES OF INTERCHANGE TRANSACTION CLASSIFICATION AND TRANSFER

	<u>From New Brunswick to New England ** - GWHR</u>					<u>From New England to New Brunswick ** - GWHR</u>				
	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
Firm Power	1584	1465	1045	740	420	0	0	0	0	0
Unit Power	0	0	0	892.0	2777.0	0	0	0	0	0
Emergency Power (Daily Capacity or Daily Supplemental)	0	0	0	0	0	1.5	0.1	50.4	2.8	0.1
Economy Energy	1215.0	971.0	555.0	869.0	555.0	6.8	0.3	7.0	17.0	38
Other	-	-	-	-	223	55	63	98	25	13

** These totals include exchanges between:

New Brunswick and Maine Electric Power

New Brunswick and Maine Public Service and Eastern Maine Electric Co-op

TABLE 2

GENERIC TYPES OF INTERNATIONAL
ELECTRIC INTERCHANGE TRANSACTIONS

NEW BRUNSWICK & MAINE

Firm Power

Capacity and energy available from surplus system reserve for six months or more. Supplier is obligated to deliver energy as scheduled unless delivery will jeopardize the security of supply to his own system.

Unit Power

Capacity and energy available from a specific unit or plant for a period of six months or more with reliability normally tied to the source unit or plant.

Emergency Power (Daily Capacity or Daily Supplemental)

Capacity and energy provided on an hourly or daily basis to supplement the generating capability of the receiving system during periods of temporary capacity deficiencies due to emergencies. Supplier is obligated to deliver energy as scheduled unless the delivery will jeopardize the security of supply to his own system.

Economy Energy

Energy delivered on an hourly or daily basis to effect fuel and other operating savings when the receiving party has adequate generation. Delivery may be terminated by either seller or buyer without notice or as mutually agreed.

Other

Miscellaneous scheduled transfers of energy between utilities not covered by the above categories, e.g., wheeling service, water/electricity exchanges, fuel diversity exchanges, lease, joint ownership, tertiary, inadvertent, etc.

APPENDIX A

NEW BRUNSWICK REGULATORY STATEMENTS ON ENVIRONMENTAL ASSESSMENT PROCEDURES

- 1) All major developments being considered by a provincial agency, department or Crown Corporation shall have an environmental impact assessment carried out prior to a decision on implementation of the project. If it is decided to proceed with the project, environmental design studies will be carried out to ensure that environmental benefits are enhanced.
- 2) Such studies shall be funded by the proponent of the project and carried out in accordance with guidelines and terms of reference approved by the Department of the Environment.
- 3) The Department of the Environment shall be responsible for reviewing these studies to determine their adequacy.
- 4) The Department of the Environment shall be responsible for holding such public meetings as it deems necessary to obtain public reaction to the environmental impact of the project.
- 5) Any conflicts which cannot be resolved between the proponents of the project and the Department of the Environment with regard to the required environmental studies shall be submitted to the Cabinet Committee on Economic Development for resolution.
- 6) The final decision on implementation of the project will be the responsibility of the government of New Brunswick.

NATIONAL ENERGY BOARD

GUIDELINES ON THE ENVIRONMENTAL INFORMATION REQUIRED WITH APPLICATIONS FOR CERTIFICATES FOR INTERNATIONAL POWER LINES

GENERAL REQUIREMENT

Section 44 of the National Energy Board Act requires the Board, before issuing a certificate for an international power line, to take into account all matters that appear to it to be relevant. The Board deems the environmental impact of a line to be one such matter. Accordingly every applicant for a certificate is required henceforth to provide an assessment of the environmental impact of the facility for which authorization is requested. The detail of the assessment should be commensurate with the magnitude and complexity of the expected impact.

APPENDIX B

There currently exists one 345 kV transmission line interconnecting the New England Power Pool with the New Brunswick Electric Power Commission. This line, which runs from Orrington, Maine to Keswick, New Brunswick, is suitable for transferring 0-600 MW of power from New Brunswick to New England. A ten year contract, terminating in 1986, is currently using 400 MW of the line capacity. While the existing line is suitable for accommodating increased transfers of up to 200 MW, additional transmission line capacity must be constructed between New Brunswick and New England if transfers in excess of 200 MW are to be accommodated. Any additional transmission line construction in Maine must comply with the laws of the state.

A summary of Maine Statutes for assessing transmission line siting suitability are listed below:

<u>Statute</u>	<u>Administering Agency</u>	<u>Resource Protected</u>
Shoreland Zoning Act (12 M.R.S.A. Sec. 4811-4814)	State Planning Office and Municipalities	Land/Water
Planning & Zoning Act (30 M.R.S.A. Sec. 4961-4964)	Municipalities	Land/Water
Land Use Regulation Laws (12 M.R.S.A. Sec. 681-689)	Land Use Regulation Commission	Land/Water
Site Location of Development Act (38 M.R.S.A. Sec. 471-478)	BEP/DEP*	Land/Water
Alteration of Coastal Wetlands (38 M.R.S.A. Sec. 471-478)	BEP/DEP	Land/Water
Public Lands Laws (12 M.R.S.A. Sec. 514-A, 532-553)	Bureau of Public Lands Land	

In addition to the above statutes, the constructing party must also obtain from the Maine Public Utilities Commission a Certificate of Public Convenience and Necessity. A short description of the regulatory procedure follows.

The Public Utilities Commission (PUC) and the Board of Environmental Protection (BEP) are the two principal regulatory State agencies in any utility transmission siting decision in Maine.

*Board of Environmental Protection/Department of Environmental Protection

Public Utilities Commission Approval

The initial step in the siting of transmission lines is to establish the need for additional facilities. The applicant must apply to the PUC for a Certificate of Public Convenience and Necessity to build any transmission lines carrying 100 kilovolts or more.

The PUC will schedule a public hearing after receiving the application. Any person, firm, or corporation, including transportation industry organizations, associations or conferences, have the right to intervene in a PUC hearing if they show direct and substantial interest in the subject matter of the proceeding, and their participation does not unduly broaden the issues (Rules of Practice and Procedure before the Public Utilities Commission of Maine, Rule 16). During the hearing, the Office of Energy Resources may provide input on forecasting of long term electrical demand and growth rates, alternative energy sources, and the effects of conservation measures. The Commission will make its final decision based on testimony presented at the hearing as well as its own findings. The PUC must also approve long term financing of any public utility project (35 M.R.S.A. Sec. 17).

Assuming the PUC has approved the utility proposal, the applicant must next seek approval for the proposed site. The State and municipal agencies involved in this step of the process will depend on the location of the proposed site as described below.

Approval for Sites in the Unorganized Territories

In the unorganized territories the Land Use Regulation Commission (LURC) has jurisdiction over zoning and land use (12 M.R.S.A. Sec. 681-689). Normally the LURC will process the application in accordance with its statutes, comprehensive plan, and procedures zoning standards promulgated pursuant to its statute. However, a public utility may be completely or partially exempt from LURC regulation if the PUC decides it is in the public welfare or convenience; in which case, LURC may only impose terms or conditions on the utility. LURC may also waive the requirement for a hearing if the proposal has received approval under the Site Location of Development Law administered by BEP.

Local Approval for Sites in the Organized Territories

Local zoning laws, including shoreland zoning under the Shoreland Zoning Act (12 M.R.S.A. Sec. 4811-4814), apply to the organized territories. If a desired site is unavailable because of zoning restrictions, the utility may seek a variance from the municipality involved. If a variance is denied, the utility may apply to the PUC for exemption from local zoning laws, including shoreland zoning (30 M.R.S.A. Sec. 4962).

Approval by State Agencies with Responsibility for Protecting the Environment

When a site is selected that meets the approval of the municipality or LURC, if in unorganized territory, the utility must comply with a number of environmental laws administered principally by the Board of Environmental Protection.

The Department of Environmental Protection coordinates and assists in the issuance of all environmental permits issued by agencies of the State within the organized municipalities. Within the unorganized territories, this function is carried out by the Land Use Regulation Commission.

The utility must obtain from the Board of Environmental Protection (the decision-making authority of the Department of Environmental Protection) BEP permits and approval of its proposed transmission line. The BEP will automatically schedule public hearings on any application deemed by the BEP to be of significant public interest. Conditions are specified in DEP Special Regulations of Hearings on Applications of Significant Public Interest (Sections 30.1-3-.26). Although a separate public hearing may be scheduled to determine compliance with each law under BEP's jurisdiction, the normal procedure is to schedule one set of hearings that covers all the laws involved. The latter action streamlines the procedure and appears to meet with the approval of both BEP and the applicant.

The most comprehensive law administered by BEP is the Site Location of Development Act (38 M.R.S.A. Sec. 481-489) since it covers all developments over 20 acres. This Act requires the applicant to demonstrate that the proposal will meet air and water pollution standards, dispose of waste properly, be built on suitable soil types, not disrupt traffic flow, or adversely affect the environment. If the proposed facility will result in any alteration of coastal wetlands, great ponds, rivers, streams or brooks, permits will be required under the corresponding acts (38 M.R.S.A. Sec. 471-478, 386-396; 12 M.R.S.A. Sec. 2206-2212 respectively). All these environmental laws are administered by BEP except the Alteration of Rivers, Streams and Brooks Act, which is under the jurisdiction of the Department of Inland Fisheries and Wildlife. In cases where this act applies joint hearings may be held with BEP; but, the final decision rests with the Commissioner of Inland Fisheries and Wildlife.

During the hearing process, testimony is received from intervenors, the public and representatives of federal, state, municipal or other governmental agencies.

Final approval by BEP of all the applicant's permits and licenses will be granted only after it has been determined by the Board that the proposal will not substantially harm or alter the natural resources protected by the appropriate laws.

Transmission lines crossing public lots, submerged land, and intertidal land requires approval from the Director of the Bureau of Public Lands (BPL). At his discretion, the Director may hold a separate hearing or act as an intervenor at a BEP hearing in any proposal to site utility transmission lines on public lands. Approval by BPL is normally granted at approximately the same time BEP approves a proposal. These two agencies are the final step of the utility siting process in Maine.

The large number of regulatory approvals required, give indication that a long lead time may be necessary to construct additional 345 kV transmission lines within the State of Maine. The time required to gain permission from the large number of state agencies and local governments which must grant approval will make the addition of transmission line capacity between the United States and Canada a lengthy process.

Report on
United States/Canada
Electric Power Exchange Study
ECAR - New York - Ontario

December, 1978

Prepared jointly by:

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R.R. Schneider - Niagara Mohawk Power Corp., New York
J.F. Aldrich - " " "
W.H. Winter - Ontario Hydro, Ontario
H.P. Smith - " " "

United States/Canada
Electric Power Exchange Study
ECAR - New York - Ontario

Introduction

In early 1978, it was agreed by senior Canadian and United States officials to give consideration to means of improving the opportunities for the bulk exchange of electricity between the two countries. Accordingly, it was decided to assemble the information noted in the Terms of Reference in Attachment 1.

This Report contains information on the first six items of the Terms of Reference in Sections of corresponding numbers. This includes a list of existing and planned interconnection facilities, data on types and magnitudes of present electricity exchanges, the identification of obstacles limiting present exchanges and the identification of opportunities for greater exchanges in the future.

The information is related to interconnections between the Province of Ontario and the following portions of the United States:

New York Power Pool - part of Northeast Power
Coordinating Council

Michigan Electric Coordinated Systems -
part of East Central Area Reliability Coordination
Agreement (ECAR)

Boise Cascade-International Falls, Minnesota
(this is an isolated load).

Ontario Hydro is also part of the Northeast Power Coordinating Council.

In addition to information on the items listed in the Terms of Reference, this Report includes in two Appendices notes on legislation and approval procedures in Ontario and in Michigan related to the construction and operation of generation and transmission facilities including those associated with the import and export of power.

1. Existing Interconnections

Interconnections between electrical utilities in Ontario and in the United States have existed for

many years. Currently, there are some 30 connections between Ontario and the States of New York, Michigan and Minnesota ranging from 500 volt lines supplying service loads to 345 kilovolt (kV) utility bulk-power interconnections. Chart 1-1 lists the major existing interconnections comprising those operating at 60 Hz and voltages of 120 kV and higher. Chart 1-2 shows the approximate geographic location of these interconnections.

The Canadian utility for each interconnection listed in Chart 1-1 is Ontario Hydro except for the Ft. Francis-International Falls line, which is owned by the Ontario-Minnesota Pulp and Paper Company (Boise Cascade) and is used for the transfer of power radially from its plant in Ft. Francis, Ontario to its plant in International Falls, Minnesota. This circuit is not included in the transfer data in Sections 1 or 4.

In addition to the lines shown on Chart 1-1 there are two 120 kV circuits routed across the Ontario-New York border near Massena, New York. These crossings are for the two circuits from Cedars Rapids generating station in Quebec to the Alcoa station near Massena, New York. Since there is no connection from these circuits to the Ontario Hydro system, they are not included in any of the transfer data between Ontario and the U.S.

The transfer capability between Ontario and the United States on each of the New York and Michigan interfaces is less than the arithmetic sum of the nominal capacities of the interconnections on each of these interfaces shown on Chart 1-1. The flow of power on the various interconnections does not divide in proportion to the capacities of the interconnections because of the differences in the electrical characteristics of the interconnected networks.

Another complicating feature in the operation of the interconnections from Ontario to Michigan and New York is the flow of circulating power around Lakes Erie and Ontario. Even with no net import or export there is usually a flow of power over the interconnections, with power leaving from Ontario to the U.S. on one interface and returning from the U.S. to Ontario on another. The circulating power flow around Lake Ontario

can be controlled by phase-shifting transformers in the two interconnections at Cornwall. There is no similar control on the circulating power around Lake Erie. Much of the time this latter flow is in the range of 0-400 MW in a counter-clockwise direction. Very infrequently it has been up to about 600 MW counter-clockwise and occasionally it has been slightly clockwise.

Taking into consideration the complicating factors mentioned in the two previous paragraphs, Chart 1-3 shows the estimated transfer capabilities for 1980 between Ontario and Michigan and between Ontario and New York based on a range of 0-400 MW of circulating power around Lake Erie in a counter-clockwise direction. It should be noted that the combined transfer capability between Ontario and the two States is less than the sum of the capabilities between Ontario and Michigan and Ontario and New York, shown on this Chart.

The transfer capability values shown in Chart 1-3 are for one generation pattern and estimated heavy load conditions in 1980. The values may change for different conditions or for transmission limitations within the systems.

2. Planned Additional Interconnections

Chart 2-1 shows the Ontario-U.S. planned additional interconnections. These comprise the connection at 345 kV of two existing border crossings in the Niagara area, one of which is now idle and one now operated at 25 Hz 69 kV.

Continuing studies are being carried out with the Michigan utilities on the need for and the alternatives available to increase the Ontario-Michigan transfer capability. As well as requiring additional interconnection facilities, major transmission additions would be necessary on the Ontario Hydro system.

No studies are underway at the present time regarding an interconnection between northwestern Ontario and power systems in Minnesota. However, opportunities may develop for interconnections in this area in the future.

3. International Electric Power Transactions

Electrical utilities in the United States and four of the provincial Canadian electrical utilities are members of Regional Electric Reliability Councils. There is close coordination among the utilities involved and types of transactions over international transmission lines are similar to those which occur on domestic transmission systems. These transactions include firm power, unit power, seasonal diversity, short term power, off-peak energy, emergency energy, economy energy, operating reserve and other miscellaneous transaction classifications. These classifications are defined in Chart 3-1.

In general, the types of transactions and the costs are determined by the utilities involved through "arms length" negotiations. The interconnection agreements and contracts are filed with the appropriate regulatory agencies for approval.

4. Magnitude of Transactions

Chart 4-1 summarizes the energy exchanges between Ontario and the United States for the years 1973 - 1977 inclusive.

5. Obstacles to Increased Electricity Transactions

Present system generation and transmission facilities have been planned on the basis of supplying the electrical utility load with design reliability. Also, interconnections between Ontario and U.S. utilities have been justified mainly on the basis of improvements in system reliability. The Ontario-U.S. transfer capability so provided has proven adequate to meet virtually all capacity and energy shortfall situations that have arisen on adjoining systems over the years, and have permitted advantage to be taken of virtually all opportunities for economy transactions. For instance, in 1974 and 1977 Ontario Hydro delivered to U.S. systems energy equivalent to 7.2% and 9.1% respectively of its primary load.

With the recent lengthening of lead times and the

increasing difficulties being experienced in obtaining clearances for new transmission, particularly in Ontario, the Ontario-U.S. transfer capabilities are expected to decrease. There is concern that this will reduce the interchange capabilities to levels that the interconnections will not be able to fulfill their system reliability enhancement role and that power and energy exchanges will be seriously curtailed.

This situation is a negative factor relative to consideration of longer term firm interconnection transactions. For firm sales the buyer must have confidence that generation, internal transmission and interconnection capacity will be added as required and that the transfer capability will be maintained for the duration of the contract.

Firm sales also require long-term assurances on reliability and price. Federal legislation on both sides of the border provides for unilateral curtailment of deliveries on national interest bases. The possibility of this happening is a serious concern about the viability of long term contracts.

To clarify the situation policy statements are required by the appropriate governments as to the extent they will permit the utilities to construct generation and transmission facilities for the export of electricity, and as to the steps which they are prepared to take to ensure approval of new generation and transmission in time to permit their construction by the dates required for contracted Ontario-U.S. exchanges. Also, policy statements are required to clearly spell out the extent to which governments will permit Ontario-U.S. utility firm contracts to be fulfilled under national emergency conditions.

Another factor, which is perceived by Ontario as a possible obstacle to increased electricity exchanges is the inherent complications in arranging transactions with non-adjointing U.S. utilities. In such cases, transmission use charges or buy/sell arrangements are necessary with the intervening systems. These transmission use charges could increase total costs to such a magnitude, particularly where long distances or

several systems are involved, that otherwise economically attractive and desirable transactions would be obviated. Furthermore, if the magnitude of the transfers through the intervening systems requires new transmission facilities, these may be difficult to arrange because of lack of incentives to these systems and public opposition. The transmission use charge reimburses the intervening systems for the portion of their system transmission capability that is used, similar to a capacity charge that reimburses the seller for the portion of generation that is used. Both of these charges in the United States must be justified to and approved by the Federal Energy Regulatory Commission before implementation.

Other factors which limit the flow of electricity across the Ontario-U.S. border are summarized briefly in the following. Some of these are related to the concerns discussed above.

5.1 Fuel

- (a) Fuel may not be available to generate power for export because of national policy or because of inadequate supplies. Contracts for purchase of fuel often contain specific restraints on its use, e.g. "take or pay" contracts can result in the operation of generation that might otherwise be displaced by importing lower cost power.

5.2 Political

- (a) At the present time export sales are limited to those:
 - which are surplus to the generation needs of the exporting system for the supply of its own load, and
 - which can be delivered over the transmission provided to supply the system load from its own resources,that is, generation and transmission cannot at present be installed specifically for the export of electricity.
- (b) Export licences impose limits on power and energy transactions both with respect to term and to quantity.

5.3 Public Acceptance

- (a) Public reaction tends to be negative towards exporting power.

5.4 Financial and Economic Factors

- (a) Difficulty in justifying new transmission and interconnection facilities on the basis of uncertain future electric power exchanges.
- (b) Difficulty in obtaining approval for transmission where the benefits cannot be directly related to the utility franchise area traversed.
- (c) Lack of flexibility in pricing can tend to reduce transactions.
- (d) Transmission use charges and transmission losses over long distances through several intervening systems may reach levels which result in uneconomic total costs to the parties, thereby nullifying the benefits of such transactions.
- (e) Treatment of purchases and sales in rate hearings and in U.S. fuel adjustment clauses has a significant influence in the desirability of purchasing or selling energy.
- (f) The price may limit the amount of interchange that can economically be scheduled.
- (g) International business involves problems of working in foreign currency and in enforcement of contracts across international boundaries.

6. Specific Opportunities for Increased Imports & Exports

Discussions are carried out on a continual basis between Ontario Hydro and utilities in the United States to consider opportunities for specific power and energy exchanges. Some of the possibilities and the obstacles affecting them are discussed in the following.

6.1 Power Exports from Ontario

As a result of the downward revisions recently made in the rate of growth of electricity in Ontario and previous commitments for generation, Ontario Hydro expects to have surpluses available for firm power sales of up to 2,000 MW through to the

latter part of the 1980's. Surpluses for sales of an additional 2,000 MW could be made available during this period on an interruptible basis. To provide for sales of these magnitudes beyond the late 1980's it would be necessary to advance planned installations of large coal-fired or nuclear stations and major transmission facilities.

Some utilities in the U.S. have indicated an interest in discussing the purchase of firm power from Ontario Hydro in the 1980-1990 period. A realistic estimate of the market for firm sales is currently judged to be 500 MW to 1,000 MW up to the mid-1980's. However, there is a great deal of uncertainty associated with the firm power market because of the utilities' uncertainties about load growth and scheduled in-service dates for generation.

Existing transmission facilities in Ontario provide little or no capability for firm power exports after allowance is made for the required capability for emergency and short term transactions. To provide a firm export capability of 500 MW to 1,000 MW in the early 1980's the following work is underway or under consideration. Most of the internal system facilities will be required later for load supply.

- Carry out an extensive program of upgrading existing 230 kV transmission and switching facilities in central and southwestern Ontario;
- Pursue and advance, if possible, the current program of obtaining approvals for new transmission facilities in southwestern Ontario;
- Construct the planned additional interconnection facilities at Niagara Falls with the New York utilities as listed in Chart 2-1;
- Install additional transformation in the Lambton-St. Clair interconnections with Michigan.

To provide a transmission capability in Ontario which would more closely match the expected generation surplus of 4,000 MW, major additional transmission and interconnection facilities would be required, such as,

- additional 500 kV transmission from the London area to the Ontario-Michigan border;
- a High-Voltage Direct-Current interconnection with utilities south of Lake Erie.

Facilities such as these could not be placed in service before the late 1980's.

The above discussion relates only to the additional facilities which would be required in Ontario. The additional facilities required in the U.S. would depend on the U.S. utilities involved in the purchase and transmission of the power and the distance of the purchaser from the Ontario-U.S. border.

6.2 Power Exports from U.S. to Ontario

Because of its current surplus generation situation, Ontario Hydro does not foresee a requirement in the next decade to purchase firm power from the U.S. Therefore, except for the possibility of diversity exchanges as discussed in Section 6.3, exports from the United States to Ontario during this period are expected to be relatively small and include such transfers as emergency power, economy energy and other miscellaneous types.

From the U.S. viewpoint, existing regulatory procedures should not hinder the sales of short-term surplus power. Public acceptance and state regulatory attitudes are not perceived as an impediment to short-term sales using existing facilities since there would be a perception of economic benefit to consumers.

Existing transmission facilities would appear adequate for short-term sales to Ontario at a realistic level. The justification for installing long-lived transmission facilities to accommodate short-term transfers would be difficult as explained in the following discussion on long-range sales.

For purposes of long-term sales, it is assumed that the concept would be one of installing generating facilities in the U.S. with all or part of such facilities dedicated to the supply of electric energy to Ontario on a reasonable long-term basis (i.e., 20 years for example). A wide variety of obstacles would exist to such an arrangement.

Regulatory - State Level

1. Although the specifics vary from state to state, a requirement exists for state regulatory approval for the construction of new generating facilities. In general such regulatory agencies are obligated to consider such issues as need for power, environmental impact, economics, alternative technologies and sites, etc. It is entirely reasonable to anticipate that state regulatory approval would not be forthcoming in the absence of significant economic advantage to the citizens of the state, coupled with general public acceptance and associated political support. Such support is viewed by many as questionable.

2. In addition to state regulatory approvals for generation construction, state regulatory approval is required for transmission line construction. In some states multiple agency approvals are required. Since in many cases associated transmission lines would traverse several states, the approval process is further complicated. The same comments with respect to economics, public and political acceptance made earlier with respect to generation hold equally true for transmission.

Regulatory - Federal Level

An export license from the Economic Regulatory Administration (ERA), and the Federal Energy Regulatory Commission (FERC) approval of the sales and transmission contracts are required. The former would likely require the development of a National Environmental Policy Act (NEPA) environmental impact statement. This obviously adds another layer of regulatory review and another uncertainty to the permitting process.

Environmental and Land Use

Most of the environmental and land use obstacles fall under the regulatory process since that is the forum where environmental impacts will be assessed. In its simplest terms, the controlling environmental factor is willingness of the public in one area to dedicate and use its environmental resources for the benefit of another area, be it elsewhere in the U.S. or in Canada.

If the construction of coal-fired plants in the U.S. were to be considered as likely power sources for export to Canada, then consideration would have to be given to air quality regulations and in particular whether or not the installation of a coal-fired power plant would "use up" some of the air quality "margin" and thereby inhibit future economic growth of that region.

Financial

The high cost of new generating facilities and their long lead time is currently placing a great financial strain on most investor-owned utilities in the U.S. The ability of such firms to raise capital to build transmission and generating facilities for sales to other than their regular customers is accordingly seriously limited.

Economic

The present planning and system expansion of U.S. utilities is greatly hampered by the uncertainties created by the multiplicity of regulatory approvals required. Financial risks are increased because significant financial commitments must be made prior to receipt of final required regulatory approvals. The additional exposure to regulatory review and intervention in projects to supply power outside the U.S. and the corresponding increase in the time between commitment and project completion, together with an increase in financial risk and power supply uncertainty, all combine to make participation of Canadian utilities in U.S. projects unattractive in the absence of truly compelling economic advantages.

6.3 Diversity Exchanges

Another possibility for electricity exchanges is Summer-Winter Diversity. In Ontario, the annual peak load occurs in the winter while in much of the United States the peak load occurs in the summer. As a result, surplus Ontario Hydro power could be delivered to United States utilities during their summer peak load period and surplus United States power could be delivered to Ontario Hydro during the Winter on an exchange basis.

Long-term agreements for such diversity exchanges present possibilities for financial savings through reduced generation requirements and savings in maintenance and energy production costs. However, an area in which oil and/or gas-fired generation is being shifted from base-load to peak-load use and load growth is being met with new nuclear or coal-fired units may not be able to justify deferment of new capacity. If the oil and/or gas-fired units were to be kept on base-load service for purposes of the diversity exchange, new generation capacity could be deferred but the added operating costs of prolonged operation of the oil and/or gas units may make it uneconomical to enter into such an agreement. Furthermore, such operation would be a violation of the recent U.S. National Energy Act."

The parties which are most apt to enter into a diversity exchange agreement are those systems, or group(s) of systems which are reasonably close to the Ontario/U.S. border. The utilities in Michigan and New York are members of ECAR and

NPCC respectively. Michigan and the rest of the ECAR Region anticipate a pattern of load growth whereby each successive winter peak demand will exceed the peak demand for the preceeding summer starting about the mid-1980's. The New York portion of NPCC anticipates a continued summer peak but the difference between winter and summer is expected to decline in the future. Also, New York has an existing diversity contract with Hydro-Quebec. Because of these factors Michigan and New York would find little incentive to enter into a diversity exchange with Ontario Hydro.

The potential for financial benefits of diversity exchanges appear more likely with U.S. utilities further south. In these cases, any substantial exchange of power with Ontario Hydro could not be consummated without extensive coordination of planning and operation among Ontario Hydro and several U.S. utilities. Ontario Hydro and these southern utilities would have concerns about reducing their generating capacity by relying on these exchanges because of,

- limitations in transmission in Ontario and, possibly in the intervening systems;
- possible federal government action to restrict energy transfers in an emergency;
- possible compromise of mutual benefits from existing interconnections;
- the heavier loading pattern which the scheduled interchange could superimpose on the transmission of the intervening utility systems and adversely effect their reliability by reducing the planned level of emergency backup;
- the increased risk associated with exposure to a greater number of transmission elements and longer transmission distances;
- the difficulties in arranging for any new transmission required in the intervening systems due to the lack of incentives and possible public opposition;
- the possibility that the cost of major transmission additions over intervening systems may negate the economic advantages,
- the dependence upon oil or gas as the primary fuel for a substantial amount of the existing generation in the candidate utilities.

Some of these difficulties could be overcome by a direct interconnection between Ontario Hydro and the summer peaking utilities using a high voltage direct current interconnection under Lake Erie.

6.4 Other Possibilities

Other possibilities for increased imports and exports include:

- (a) More extensive coordination of planning and operation among Ontario Hydro and the U.S. utilities;
- (b) Advancement of generation for export.

APPENDIX I

Legislation Affecting Ontario Facilities

The following notes briefly describe the major legislation affecting the acquisition of property, construction and operation of generation and transmission facilities in the Province of Ontario with particular reference to interconnections with utilities in the United States.

1. Provincial Legislation

1.1 The Power Corporation Act

Ontario Hydro operates under The Power Corporation Act. This Act provides that the Lieutenant Governor in Council may, upon the recommendation of Ontario Hydro, authorize the Corporation, among other things, to acquire property rights and construct works for the generation, transmission and distribution of electric power. This authorization is done through an Order-in-Council.

1.2 The Environmental Assessment Act

This Act and the process which it sets out is followed for the review and approval of Ontario Hydro undertakings prior to the granting of an Order-in-Council. As the proponent, Ontario Hydro is required to prepare an Environmental Assessment document for submission to the Ministry of the Environment. An Environmental Assessment Board Hearing is likely to be required for all major projects.

1.3 The Expropriations Act

The authorization obtained under The Power Corporation Act includes the power to expropriate, if necessary. An expropriation by Ontario Hydro must be approved by the Minister of Energy. An owner has the right to request an inquiry hearing to consider whether the taking of the land is fair, sound and reasonably necessary. The Lieutenant Governor in Council may direct that an expropriation proceed without a hearing, but this is rarely done.

1.4 The Planning Act

Ontario Hydro's proposal as submitted under The Environmental Assessment Act may be in conflict with the official plan and zoning by-laws of a municipality passed pursuant to The Planning Act. If the proposed undertaking is in conflict, Ontario Hydro must apply to the municipality for an amendment of the official plan and the by-laws. If the municipality refuses Hydro's application, it is necessary to apply to the Ontario Municipal Board for a hearing to have the official plan or zoning changed.

1.5 Other Provincial Legislation

Other Provincial legislation which may have application to Ontario Hydro projects includes the following:

- (a) The Niagara Escarpment Planning & Development Act.
- (b) Environmental Protection Act.
- (c) Ontario Water Resources Act.
- (d) The Parkway Belt Planning and Development Act.
- (e) Regional Government Acts.
- (f) The Municipal Act.
- (g) The Public Service Works on Highways Act.

2. Federal Government

2.1 Navigable Waters Protection Act

This Act applies to any construction in, over or under a navigable waterway. Submissions are made to the Department of Transport for its recommendations and approval of clearances and marking. These recommendations take into account requirements of authorities such as civil aviation and the St. Lawrence Seaway, where applicable.

2.2 The National Energy Board Act

In Canada, regulatory authority over exports of electricity and operation of international power lines is under the National Energy Board Act. A description of the Act and authorization procedures are planned to be included in the joint report by the Federal Governments of Canada and the United States.

2.3 The Canadian National Power Policy

A statement of the National Power Policy for Canada, dated October 8, 1963, by the Honourable Mitchell Sharp, then Minister of Trade and Commerce, is also planned to be included in the joint report by the Federal Governments of Canada and the United States.

2.4 Other Federal Legislation

Other Federal legislation which may have application to Ontario Hydro projects includes the following:

- (a) Atomic Energy Control Act
- (b) International Boundary Act.
- (c) Fisheries Act.
- (d) Aeronautics Act.

APPENDIX II

Regulatory Procedures Affecting Michigan Facilities

1. The United States Federal Energy Regulatory Commission (FERC)

FERC has jurisdiction over all interstate and international transaction rates and rates on wholesale power and energy for resale. All interconnection agreements, amendments, supplements, etc. for public utilities along with justification for rate changes are filed with FERC. All actual investments, revenues, expenses, load, capability, interchange, facilities, etc. are reported to FERC along with ten-year forecasted load, planned generation and transmission facilities, etc. Public hearings may be held if contested by FERC or others. Intervenor's petitions are ruled on by FERC.

2. Michigan Public Service Commission (MPSC)

The Michigan Public Service Commission "is vested with power and jurisdiction to regulate all rates, fares, fees, charges, services, rules, conditions of service and all other matters pertaining to the formation, operation or direction of such public utilities."

Hearings in main rate cases last anywhere from 50 to 90 days, involve 20 to 25 intervenors, and require the lapse of 12 to 14 months between the filing of an application and the obtaining of a final order and are now occurring on an approximate 16-month cycle.

The Commission is also required, pursuant to Act 144, to approve all long term financing for Michigan electric utilities. In recent years, the approval process has evolved into a review of a utility's load forecasts and construction program to determine whether the financing plans are "necessary for the acquisition of property, the construction, completion, extension or improvement of facilities or for the improvement or maintenance of service" Hearings in these matters have taken four to eight months from application to decision.

The Commission has incorporated the following purchased and net interchange power clause into the major electric utility company rate schedules:

"(t) his clause will operate to recognize in a timely manner increases or decreases in costs incurred or revenues received by applicant for the purchase or sale of electric energy. It should also operate in a manner which recognizes

90 per cent of the increases or decreases in the cost of electrical power purchased or sold on a monthly basis."

The Commission went on to state as follows:

"To facilitate verification of booked expense, applicant shall record all net purchased and interchange power expense in Account 555 of the Uniform System of Accounts ... Such revenues will act as an offset to expenses incurred for purposes of the adjustment clause."

Account 555 of the Uniform System of Accounts provides as follows:

"A. This account shall include the cost at point of receipt by the utility of electricity purchased for resale. It shall include, also, net settlements for exchange of electricity or power, such as economy energy, off-peak energy for on-peak energy, spinning reserve capacity, etc. In addition, the account shall include the net settlements for transactions under pooling or interconnection agreements wherein there is a balancing of debits or credits for energy, capacity, etc.....

B. The records supporting this account shall show, by months, the demands and demand charges, kilowatt-hours and prices thereof under each purchase contract and the charges and credits under each exchange or power pooling contract."

The fuel cost adjustment clause (FCAC) was designed so that changes in the cost of the fuel burned to produce electrical energy would also theoretically reflect changes in the cost of the fuel component of electrical energy purchased from other utility companies. The Commission approved that only 90 per cent of the FCAC adjustments calculated on a monthly basis will be passed on to the customer after a three-month lag. The purchased and net interchange power clause will operate in tandem with the FCAC to assure that the lowest cost available electric energy is provided to the utility's customers at all times.

The purchased power clause and fuel adjustment clause, along with any other provision of our tariff sheets, is always subject to major revision or elimination by the Michigan Public Service Commission. A hearing is held each month to determine the amount and appropriateness of the purchased power costs to be included in monthly billings for the following month.

3. Transmission

Right-of-way for transmission may be obtained by negotiations with the owners or by condemnation procedures. In condemnation procedures, three local people are assigned to act as a jury by a judge to hear the proceeding and make recommendations as to the necessity of the condemnation and the value of the property. The judge may accept or reject the recommendations. A Presidential Permit is required under the terms of Executive Order 10485 for permission to erect facilities for transmission of electric energy between the United States and a foreign country.

Interconnections between Michigan and Canada must comply with regulations of FERC, U.S. Army Corps of Engineers, Federal Aviation Administration and a construction permit from the MPSC is required. The need, purpose, profile, setting, engineering design characteristics must be demonstrated or proven. The environmental inventory includes archaeological studies, climate, soils, topography and vegetation, water resources, wildlife, land use, population, economics and transportation. The route selection includes evaluations of several alternate routes. Some of the other agencies involved are as follows:

- Michigan State Highway Department
- Michigan Aeronautics Commission
- Michigan Department of Natural Resources
- County and City Regional Planning Commissions
- County Airport Commissions
- County Road Commissions
- National Weather Service
- Railroads
- Local Building Permit
- Local Zoning Boards
- Soil Erosion and Sedimentary Controls
- Other Utilities Crossed
- Township Boards.

ATTACHMENT 1

TERMS OF REFERENCE

FOR STUDY ON OPPORTUNITIES FOR EXPANDED

CANADA-U.S. ELECTRICITY EXCHANGE

1. List the interconnections now in service, their capacity and the transfer capability of the different interfaces.
2. Describe firm and tentative plans for additional interconnection capacity.
3. Identify and define the generic types of transactions that take place on interconnection.
 - (a) Economy
 - (b) Short term firm
 - (c) Intermediate and long term firm
 - (d) Dedicated facilities
 - (e) Seasonal diversity
 - (f) Source diversity (fuel)
 - (g) Reserve sharing
 - (h) Other

Illustrate with examples of existing transactions.

4. Provide data on the magnitude of the various types of transactions that have taken place the past few years.
5. Identify reasons and obstacles in each country by region why the transactions in item 4 are not greater or other types are not employed.
 - (a) Jurisdictional
 - (b) Regulatory
 - (c) Environmental
 - (d) Land use
 - (e) Financial and Economic
 - (f) Political
 - (g) Public Acceptance
6. Identify specific opportunities in each country, by region, for increased imports and exports. List obstacles affecting these transactions.
7. Suggest procedures to resolve obstacles. Recommend action by governments (federal, provincial, states), utilities, regulatory bodies, others.
8. Appendices - provide documentation or references to statistical and other data as necessary to support items 1 to 7.

June 13, 1978

Attachment 1

CHART 1-1

EXISTING AND AUTHORIZED ONTARIO - UNITED STATES ELECTRIC POWER INTERCONNECTIONS

<u>Terminal Stations</u>		<u>Operating Designation</u>	<u>Operating Voltage kV</u>	<u>Nominal Capacity (Note 1)</u>	
<u>Ontario</u>	<u>U.S.</u>			<u>Summer (MVA)</u>	<u>Winter (MVA)</u>
ONTARIO - NEW YORK					
St. Lawrence	Moses (St. Lawrence)	L33P	230	300	360
St. Lawrence	Moses (St. Lawrence)	L34P	230	300	360
Beck	Packard	BP76	230	470	550
Beck	Niagara	PA27	230	400	480
ONTARIO - MICHIGAN					
Sarnia-Scott	Bunce Creek	B3N	230	535	590
Lambton	St. Clair	L4D	345	710	800
Lambton	St. Clair	L51D	345	760	875
J.C. Keith	Waterman	J5D	230	515	570
ONTARIO - MINNESOTA					
Fort Frances	International Falls	F3B	120	35	35 (Note 2)

NOTES:

1. The nominal capacity is the day-to-day loading capability of the interconnections.
2. This interconnection is owned by and forms an interconnection between Canadian and U.S. portions of the Ontario-Minnesota Pulp and Paper Co. (Boise Cascade).
3. Only 60Hz interconnections 120 kV and above are shown.

GEOGRAPHIC LOCATION OF INTERCONNECTIONS
ONTARIO - USA

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CHART 1-3

Ontario-New York-Michigan Transfer Capability

1980

<u>Transfers</u>	<u>Summer Transfers to U.S. Mw</u>	<u>Winter Transfers to Ontario Mw</u>
Ontario and Michigan (zero to New York)	1200 - 2000	600 - 1100
Ontario and New York (zero to Michigan)	1500 - 2200	1300 - 2000
Ontario, Michigan and New York	2000 - 2700	1700 - 2400

Note:

Transfer capabilities shown are based on a range of 0-400 Mw circulating power around Lake Erie in a counter-clockwise direction with the larger transfer value corresponding to the smaller circulating power.

CHART 2-1

PLANNED ADDITIONAL ONTARIO - UNITED STATES ELECTRIC POWER INTERCONNECTIONS

<u>Terminal Stations</u>		<u>Operating Designation</u>	<u>Operating Voltage kV</u>	<u>Nominal</u>	<u>Capacity</u>	<u>(Note 1) Status</u>
<u>Ontario</u>	<u>U.S.</u>			<u>Summer (MVA)</u>	<u>Winter (MVA)</u>	
ONTARIO - NEW YORK						
Beck	Niagara	-	345	1150	1400	(I/S-1981)
Beck	Niagara	-	345	1150	1400	(I/S-1983)

ONTARIO - MICHIGAN

None.

NOTES:

1. The nominal capacity is the day-to-day loading capability of the interconnections.

Chart 3-1

Generic Types of International Electric Power Transactions

- (1) **Firm Power** - Capacity and energy available from surplus system reserve for an extended period, normally six months or more. Supplier is obligated to deliver energy as scheduled unless delivery will jeopardize the security of supply to his own system.
- (2) **Unit Power** - Capacity and energy available from a specific unit or plant for an extended period, normally six months or more, with reliability normally tied to the source unit or plant.
- (3) **Seasonal Diversity Power** - Capacity and energy exchanged between utilities with annual peak loads in different seasons (summer versus winter) from surplus reserve for one or more years. Supplier is obligated to deliver energy as scheduled unless delivery will jeopardize the security of supply to his own system.
- (4) **Short Term Power** - Capacity and energy provided from system reserve to supplement the generating capability of the receiving party on a weekly basis. Supplier is obligated to deliver energy as scheduled unless delivery will jeopardize the security of supply to his own system.
- (5) **Off-Peak Energy** - Energy provided normally during off-peak periods for one or more weeks to supplement or conserve fuel storages (fossil or hydraulic) of the receiving system.

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Chart 3-1

Page 1

- (6) **Emergency Power** - Capacity and energy provided on an hourly or daily basis to supplement the generating capability of the receiving system during periods of temporary capacity deficiencies due to emergencies. Supplier is obligated to deliver energy as scheduled unless the delivery will jeopardize the security of supply to his own system.
- (7) **Economy Energy** - Energy delivered on an hourly or daily basis to effect fuel and other operating savings when the receiving party has adequate generation. Delivery may be terminated by either seller or buyer without notice or as mutually agreed.
- (8) **Operating Reserve** - Excess generating capacity held available on ten minutes or less notice by one system for use by another system in meeting its operating Reserve requirements.
- (9) **Other** - Miscellaneous scheduled transfers of energy between utilities not covered by the above categories, e.g. wheeling service, water/electricity exchanges, fuel diversity exchanges, lease, joint ownership, tertiary, etc.
- Unscheduled transfers of energy, e.g. inadvertent, etc.

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Chart 3-1

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Chart 4-1

Magnitude of Transactions - Ontario/US
(GWh)

<u>Transactions</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>Total</u>
<u>Ontario to New York:</u>						
Firm Power (CNP to N.M)*	327	304	239	170	146	1,186
Economy	41	22	351	627	2,027	3,068
Emergency	1,514	1,544	233	609	139	4,039
Short Term Power	858	1,402	72	16	122	2,470
Other (OH-Pasny unit rentals) **	16	59	192	154	148	569
Total	2,756	3,331	1,087	1,576	2,582	11,332
<u>New York to Ontario:</u>						
Economy	5	2	1	4	10	22
Emergency ***	3	5	5	9	8	30
Short Term Power	0	7	0	0	0	7
Other (OH-Pasny unit rentals)	142	379	437	423	455	1,836
Total	150	393	443	436	473	1,895

* (CNP to NM is Canadian Niagara Power to Niagara Mohawk)

Ontario to Michigan:

Economy	218	16	366	1,796	3,219	5,615
Emergency	296	418	720	782	1,483	3,699
Short Term Power	2,347	2,511	205	239	1,410	6,712
Seasonal Diversity	88	0	0	0	0	88
Total	2,949	2,945	1,291	2,817	6,112	16,114

Michigan to Ontario:

Short Term Power	0	21	0	39	0	60
Seasonal Diversity	39	0	0	0	0	39
Total	39	21	0	39	0	99

Total to US: (Transfers for Ontario to Minnesota not included.)

Firm Power	327	304	239	170	146	1,186
Economy	259	38	717	2,423	5,246	8,683
Emergency	1,810	1,962	953	1,391	1,622	7,738
Short Term Power	3,205	3,913	277	255	1,532	9,182
Seasonal Diversity	88	0	0	0	0	88
Other	16	59	192	154	148	569
Total	5,705	6,276	2,378	4,393	8,694	27,446

Total to Ontario:

Economy	5	2	1	4	10	22
Emergency	3	5	5	9	8	30
Short Term Power	0	28	0	39	0	67
Seasonal Diversity	39	0	0	0	0	39
Other	142	379	437	423	455	1,836
Total	189	414	443	475	473	1,994

** Also includes CNP interruptible to NM, and St. Lawrence Power (SLP) to US

*** Includes SLP to NM

1978-12-1
Chart 4-1

Nebraska Public Power District

GENERAL OFFICE
P. O. BOX 499, COLUMBUS, NEBRASKA 68601
TELEPHONE (402) 564-8561

December 21, 1978

Dr. Charles A. Falcone, Director
Division of Power Supply and Reliability
Economic Regulatory Administration
Department of Energy
Washington, D.C. 20461

Dear Dr. Falcone:

The Joint U.S.-Canadian regional report for MARCA, Province of Manitoba and Province of Saskatchewan as directed under the US/Canadian Electricity Exchanges Study is attached. This regional report was developed by representatives of the region consisting of: L. Ingram - Manitoba Hydro Electric Board; G. Spafford - Province of Manitoba; J. McClement - Saskatchewan Power Corp.; P. Black - Province of Saskatchewan; D. A. Rice - Nebraska Public Power District; T. Weaver - Western Area Power Administration; D. Hawthorne - MAPP Coordination Center; D. W. Angland - Northern States Power and D. E. Schaufelberger - MARCA.

U.S.-Canadian electric power and energy transactions within the MARCA region have been limited to date mainly by transmission capability which is evident from the minimal number and capacity of existing interconnections and the relatively recent development of such interconnections. Transactions are further restricted because these interconnections are limited to adjacent U.S.-Canadian utilities which inherently have similar seasonal load requirements.

Incentive for development of large capacity transmission interconnections between the U. S. and Canada within the MARCA Region was minimal prior to recognition of the energy crisis, significantly increased fossil fuel costs and prevailing inflation relative to utility generating plant construction costs. Prior to the propagation of these events, base-load capacity expansion was less prohibitive. U. S. border states could take advantage of nearby lignite fields as a competitive fuel source, and oil-fired peaking capacity generation was an attractive means of serving seasonal peak load requirements for both summer and winter peaking utilities. Aggregately, these factors detracted from the necessity and the feasibility of constructing U. S.-Canadian transmission interconnections of substantial length and/or capacity.

Three committed new transmission interconnection projects exist within the MARCA Region providing the capability for significantly increasing U.S.-Canadian transactions. The three transmission interconnections consist of a 500 KV AC line between Winnipeg, Manitoba and Minneapolis, Minnesota, a 230 KV AC line between Boundary Dam, Saskatchewan and Tioga, North Dakota and a + 450 KV DC or 500 KV AC transmission line from Winnipeg, Manitoba to Hoskins, Nebraska.

Dr. Charles A. Falcone, Director
December 21, 1978
Page -2-

The Winnipeg-Twin Cities 500 KV interconnection between Manitoba Hydro Electric Board (MHEB) and Northern States Power (NSP) will be constructed for the purpose of transferring power and energy from MHEB to NSP during the summer seasons and from NSP to MHEB during the winter seasons thus taking advantage of the seasonal load diversity of the two systems. The power transfers will involve a seasonal diversity exchange, sales of firm power and energy and surplus energy sales for a 13-year period beginning in 1980.

The Boundary Dam-Tioga 230 KV interconnection between Saskatchewan Power Corporation and Basin Electric Power Coop will be in service in 1981 providing transmission capability for 100 MW of seasonal exchange as well as other shorter term transactions.

The MANDAN project will interconnect extreme winter peaking utility systems in Manitoba, Canada and North Dakota with extreme summer peaking systems in Nebraska, South Dakota, and neighboring states to take advantage of the seasonal diversity which exists within the region. MANDAN is to be placed in service in 1985, and is planned as either a 500 KV AC or a $\pm$ 450 KV DC configuration. Several types of transactions will be facilitated by MANDAN, including seasonal diversity, participation, economy, energy storage and replacement for adverse water conditions.

Representatives on this Joint Committee in the MARCA Region feel opportunities exist within the region for increased U.S.-Canadian power and energy levels of exchange for nearly all type of transactions. Potential for most of these transactions increases with the north-south distance traversed. The greatest limitation on this capability has been the lack of adequate transmission interconnection facilities and the obstacles that must be overcome. The new transmission interconnections that are committed will provide adequate capability to take advantage of anticipated U.S.-Canadian energy exchanges.

Sincerely,

D. E. Schaufelberger
Chm., MARCA ad hoc Committee
US/Canadian Electricity Exchange

/kz
attach.

cc: D. Hawthorn w/attach.
D. Angland w/attach.
T. Weaver w/attach.
J. McClement w/attach.
G. Spafford w/attach.
P. Black w/attach.
D. Rice w/attach.

Sincerely,

L. Ingram, P.E.
Canadian Chairman
US/Canadian Electricity Exchange

**Joint United States/Canadian
Electric Power Interchange Study**

**Study on Opportunities for Expanded
Canadian/United States Electricity Exchange**

**MARCA Region
12/21/78**

PROPOSED TERM OF REFERENCE
FOR STUDY ON OPPORTUNITIES FOR EXPANDED
CANADA-U.S. ELECTRICITY EXCHANGE

1. List the interconnections now in service, their capacity and the transfer capability of the different interfaces.
2. Describe firm and tentative plans for additional interconnection capacity.
3. Identify and define the generic types of transactions that take place on interconnection.
 - (a) Economy
 - (b) Short term firm
 - (c) Intermediate and long term firm
 - (d) Dedicated facilities
 - (e) Seasonal diversity
 - (f) Source diversity (fuel)
 - (g) Reserve sharing
 - (h) Other

Illustrate with examples of existing transactions.

4. Provide data on the magnitude of the various types of transactions that have taken place the past few years.
5. Identify reasons and obstacles in each country by region why the transactions in item 4 are not greater or other types are not employed.
 - (a) Jurisdictional
 - (b) Regulatory
 - (c) Environmental
 - (d) Land use
 - (e) Financial
 - (f) Political
 - (g) Public Acceptance
6. Identify specific opportunities in each country, by region, for increased imports and exports. List obstacles affecting these transactions.
7. Suggest procedures to resolve obstacles. Recommend action by governments (federal, provincial, state), utilities, regulatory bodies, others.
8. Appendices - provide documentation or references to statistical and other data as necessary to support items 1 to 7.

April 21, 1978

Item 1: List the interconnections now in service, their capacity and the transfer capability of the different interfaces.

There are presently two interconnections between the Manitoba Hydro Electric Board (MHEB) and the MARCA Region: A 230 kV A.C. line (L20P) from Laverendrye (Winnipeg Area) to Drayton (Northeastern North Dakota); a 230 kV A.C. line (R50L) from Ridgeway (Winnipeg Area) to H. Running Substation at Little Fork.

The thermal capacity of L20P is 380 MW and of R50L is 366 MW. However, in actual operation, the transfer capability is limited to much lower values by voltage and system stability considerations.

Export limits from MHEB to the U.S.:

With only L20P in service: 225 MW

With only R50L in service: 150 MW

With both lines in service: *400 MW

Import limits by MHEB from the U.S.:

With only L20P in service: 225 MW

With only R50L in service: 200 MW

With both lines in service: 300-330** MW

*400 MW is the nominal limit. The actual export value has ranged from about 300 MW to about 550 MW, depending upon voltage conditions in the Grand Forks Area.

**Varies depending upon Grand Forks voltage.

Item 2: Describe firm and tentative plans for additional interconnection capacity.

Description in Item 6 covers all interconnection plans.

Item 3: Identify and define the generic types of transactions that take place on interconnection.

In general, the Canada/MARCA agreements can be divided into two general classifications:

- a) Firm--This covers the types of transactions which have the degree of firmness that they could be utilized in delaying installations of equipment.

Firm--Firm power, short term, peaking, and participation.

- b) Interruptible--This covers types of transactions which are made for short term economic reasons and to assist systems in overcoming short term operating problems. Manitoba/MARCA types are:

Interruptible--Economy, tertiary, scheduled outage energy, spinning reserve service, interchange energy, and operational control.

Provide data on the magnitude of the various types of transactions that have taken place the past few years. Transactions are on a calendar year basis.

Item 4: Provide data on the magnitude of the various types of transactions that have taken place the past few years.

PURCHASES FROM MANITOBA HYDRO

MWH

<u>FIRM</u>	<u>NSP</u>	<u>OTP</u>	<u>MPC</u>	<u>MPL</u>	<u>TOTAL</u>
1974					
Short-term	22,680				22,680
Peaking		160,621	22,843	0	183,464
	<u>22,680</u>	<u>160,621</u>	<u>22,843</u>	<u>0</u>	<u>206,144</u>
1975					
Peaking	0	147,343	0	0	147,343
1976					
Short-term	0	0	3,873	0	3,873
Peaking	<u>0</u>	<u>48,906</u>	<u>38,214</u>	<u>16,785</u>	<u>103,905</u>
	0	48,906	42,087	16,785	107,778
1977					
Short-term			8,083		8,083
Peaking		<u>75,013</u>		<u>160,292</u>	<u>235,305</u>
		75,013	8,083	160,292	243,388

INTERRUPTIBLE

MWH

1974					
Economy	657,907	2,184	31,896	0	691,987
Operational Control	95,555	4,287	0	0	99,842
Scheduled Outage	134,624	67,655	150,345	0	352,624
Emergency	<u>0</u>	<u>0</u>	<u>243</u>	<u>0</u>	<u>243</u>
	888,086	74,126	182,484	0	1,144,696
1975					
Economy	548,172	1,279	42,438	0	591,889
Operational Control	27,776	3,114	32,452	0	63,342
Scheduled Outage	603	123,929	226,528	0	351,060
Emergency	<u>0</u>	<u>0</u>	<u>302</u>	<u>0</u>	<u>302</u>
	576,551	128,322	301,720	0	1,006,593
1976					
Economy	347,963	18,713	84,059	0	450,735
Operational Control	0	0	0	0	0
Scheduled Outages	2,010	37,568	57,190	0	96,768
Emergency	0	0	633	0	633
Interchange	<u>0</u>	<u>0</u>	<u>11,423</u>	<u>0</u>	<u>11,423</u>
	349,973	56,281	153,305	0	559,559

INTERRUPTIBLE (Cont'd)MWH

1977

Economy	8,028	990	0	607	9,625
Operational Control	435	90	0	300	825
Scheduled Outages	49,853	46,009	174,975	30,403	301,240
Emergency	0	0	827	0	827
Interchange	0	20,000	43,843	0	63,843
	<u>58,316</u>	<u>67,089</u>	<u>219,645</u>	<u>31,310</u>	<u>376,360</u>

SALES TO MANITOBA HYDRO

FIRM

	<u>NSP</u>	<u>OTP</u>	<u>MPC</u>	<u>MPL</u>	<u>TOTAL</u>
1974--None					0
1975--None					0
1976					
Short-term	7,185	0	0	0	7,185
Peaking	<u>38,265</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>38,265</u>
	45,450	0	0	0	45,450
1977					
Short-term	35,720	0	0	0	35,720
Peaking	<u>128,029</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>128,029</u>
	163,749	0	0	0	163,749

INTERRUPTIBLE

1974--None

1975

Economy	2,400	1,240	0	0	3,640
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1976

Economy	222,122	62,077	11,667	3,808	299,674
Scheduled Outages	10,432	37	2,175	0	12,644
Emergency	198	0	12	110	320
Interchange	0	0	14,669	0	14,669
Operational Control	0	0	640	0	640
	<u>232,752</u>	<u>62,114</u>	<u>29,163</u>	<u>3,918</u>	<u>327,947</u>

1977

Economy	458,790	16,182	43,680	77,759	596,411
Scheduled Outages	91,184	78,747	1,438	1,010	172,379
Emergency	200	0	0	0	200
Interchange	0	20,000	26,617	0	46,617
	<u>550,174</u>	<u>114,929</u>	<u>71,735</u>	<u>78,769</u>	<u>815,607</u>

Item 5: "Identify reasons and obstacles in each country by region why the transactions in item 4 are not greater or other types are not employed.

(a) Jurisdictional (b) Regulatory (c) Environmental (d) Land Use

(e) Financial (f) Political (g) Public Acceptance"

U.S.-Canadian electric power and energy transactions within the MARCA region have been limited to date for various reasons. The magnitude and types of transactions are currently constrained by limited transmission capacity, which is evident from the minimal number and capacity of existing interconnections and the relatively recent development of such interconnections. Transactions are further restricted because these interconnections exist between adjacent U.S.-Canadian utilities which inherently have similar seasonal load requirements thus diminishing seasonal diversity exchange opportunities.

Incentive for development of large capacity transmission interconnection between the U.S. and Canada within the MARCA region was minimal prior to recognition of the energy crisis, significantly increased fossil fuel costs and prevailing inflation relative to utility generating plant construction costs. Prior to the propagation of these events, the cost of base-load capacity expansion was less prohibitive, U.S. border states could take advantage of nearby lignite fields as a competitive fuel source, and oil-fired peaking capacity generation was an attractive means of serving seasonal peak load requirements for both summer and winter peaking utilities. Aggregately, these factors detracted from the necessity and the feasibility of constructing U.S.-Canadian transmission interconnections of substantial length and/or capacity.

Joint U.S.-Canadian utility resource planning and coordinated governmental/industry efforts relative to jurisdictional, regulatory, environmental, land use, finance, political and public acceptance aspects of international transmission interconnections have previously been minimal. Although the basis for this fact is partially related to the historic lack of incentive discussed previously, the absence of such efforts certainly impedes the development and utilization of improved U.S.-Canadian transactions while the value is becoming increasingly more significant.

Item 6: "Identify specific opportunities in each county, by region, for increased imports and exports. List obstacles affecting these transactions."

Opportunities exist within the MARCA region for significantly increased U.S.-Canadian transactions. Three committed transmission interconnection projects which will affect such increases are described below. (Refer to map in Exhibit A)

Project:	Winnipeg-Twin Cities	Boundary Dam-Tioga	MANDAN
Province:	Manitoba	Saskatchewan	Manitoba
State(s):	Minnesota	North Dakota	Nebraska & Dakotas
In Service:	1980	1981	1985
Voltage:	500 KVAC	230 KVAC	+ 450 KVDC or 500 KVAC
Transaction:	300 MW	100 MW	900 MW*
	Seasonal Diversity and 200 MW Firm Capacity South	Seasonal Diversity	Seasonal Diversity

*700 MW with Manitoba and 200 MW with other systems

The Winnipeg-Twin Cities 500 kV interconnection between Manitoba Hydro Electric Board (MHEB) and Northern States Power (NSP) will be constructed for the purpose of transferring power and energy from MHEB to NSP during the summer seasons and from NSP to MHEB during the winter seasons thus taking advantage of the seasonal load diversity of the two systems. The power transfers will involve a seasonal diversity exchange of 300 MW firm capacity at 20% load factor on a monthly basis for a 13-year period beginning in 1980. In addition, MHEB will sell to NSP 200 MW of firm capacity at 20% load factor during the summer seasons for the first four years, with provisions for continuation. An average of 1500 GWh surplus hydro energy will be transferred from MHEB to NSP in each summer season during the 13 year period contingent upon MHEB's water conditions; and when adverse water conditions prevail NSP will provide MHEB up to 1500 GWh energy in the winter seasons.

The MANDAN project will interconnect extreme winter peaking utility systems in Manitoba, Canada and North Dakota with extreme summer peaking systems in Nebraska, South Dakota, and neighboring states to take advantage of the seasonal diversity which exists within the region for a number of years. MANDAN is to be placed in service at the earliest possible date, currently expected to be 1985, and is planned as either a 500 kV AC or a + 450 kV DC configuration. If the 500 kV AC alternative is selected, provision will be made for substations in the Grand Forks area of North Dakota and the Sioux Falls area of South Dakota. If the + 450 kV DC alternative is selected, the line will be designed for multi-terminal operation including North and South Dakota terminals.

Several types of transactions will be facilitated by MANDAN, including seasonal diversity, participation, economy, energy storage and replacement for adverse water conditions.

Another U.S.-Canadian interconnection presently being discussed is a 500 kV AC transmission line between Brandon, Manitoba and the Bismark, North Dakota area. Purchase of the total output of a Canadian hydro generating station is contemplated in conjunction with this project.

Additional opportunities exist within the MARCA region for increased U.S.-Canadian power and energy exchange levels for nearly all types of transactions, including firm and participation (short and long term), capacity purchase, seasonal diversity, economy, daily, monthly, and seasonal energy storage and adverse water replacement energy. The potential for most of these transactions increases proportionately with the north/south distance traversed within the constraints of economic cost/benefit determinants, because of the amount and assurance of long term seasonal diversity which inherently results. The greatest limitation imposed upon this capability is the lack of adequate transmission interconnection facilities, and the attendant obstacles which must be overcome in providing such facilities.

The necessity of traversing greater distances with transmission facilities propagates prevailing obstacles, which normally impede intrastate construction of similar facilities, because of the compounding effects of uncoordinated and inconsistent regulatory and jurisdictional requirements upon interstate/international facilities. These obstacles which may be generally categorized in the areas of jurisdictional, regulatory, environmental, land use, financial, and public acceptance are described as follows:

JURISDICTIONAL AND REGULATORY

Jurisdictional and regulatory obstacles are primarily the result of overlapping and redundant requirements which create "red tape" as evidenced by the fact that several governmental agencies have broad jurisdiction concerning exchange of power between the U.S. and Canada. In Canada all cross-border energy sales are subject to Federal Government approval and, additionally, sales outside Canada are conditional upon proof before the National Energy Board that no comparable Canadian market is available. In the U.S. a Federal permit^(A) is required for construction, connection, operation and maintenance of transmission facilities at an international border. This permit designates the point at which a line may cross the border and is issued by the Secretary of Energy when a proposed project is found consistent with the public interest after obtaining the recommendations of the Secretary of Defense and Secretary of State. Additionally, a U.S. Federal order^(B) is required to transmit any electrical energy from the U.S. to a foreign country. This order is issued by the Secretary of Energy if, after opportunity for a hearing, he determines that the proposed project does not impair the adequate supply of electricity in the U.S. or impede the coordination in the public interest of facilities subject to Federal Energy Regulatory Commission (FERC) jurisdiction.

Other U.S. Federal agencies may acquire jurisdiction in certain instances such as Department of Interior whenever a proposed line route crosses Federal lands, such as Indian Reservations or National Wildlife Refuges; Army Corps of Engineers for construction across any navigable waterway in the U.S.; and various other governmental agencies which provide partial or total financial support.

FOOTNOTES - Refer to Item 8

State Public Utility Commissions often have jurisdiction over transmission facilities for the exchange of power with Canada. Many states now have energy facility siting laws with second review and approval by state agencies, counties and towns.

The number of governmental entities which have jurisdiction over transmission facilities for the exchange of electricity between the U.S. and Canada necessarily results in increased time requirements to secure the necessary approvals. Overlapping reviews of the same areas cause cost increases and time delays which discourage utilities and create apprehension toward commitment of project funds, thus decreasing the probability that viable projects will be undertaken.

ENVIRONMENTAL

Environmental obstacles are primarily jurisdictional in nature since numerous state and Federal agencies are required to take action on international projects. An Environmental Impact Statement (EIS)^C is required whenever Federal agencies propose to take major action concerning the quality of the human environment and more than one Federal agency is normally required to take "major Federal action" within the scope of the National Environmental Policy Act (NEPA) relative to proposed transmission lines to Canada. This requirement is satisfied by preparation of only one EIS in accordance with the "lead agency" concept embodied in the Council of Environmental Quality's (CEQ) existing guidelines and proposed regulations, however potential obstacles are created due to the sheer volume and complexity of EIS data required. All preparatory work concerning an EIS is the responsibility of the applicant, but

FOOTNOTES - Refer to Item 8

the actual documents are prepared by the lead agency and this time-consuming process is further compounded by the Federal requirement for a full and independent environmental assessment of the entire project.

A proposed Executive Order (EO), if adopted, could create an additional and unnecessary obstacle to U.S.-Canadian electricity exchanges. The EO provides generally for the evaluation of environmental impacts of U.S. projects in foreign countries. The EO could be interpreted to require preparation of an environmental study or a concise review of the environmental issues involved with respect to the effects of such projects. This interpretation appears unwarranted, however, since any interconnection will involve some type of Canadian environmental assessment. (Canada adopted a Federal Environmental Assessment Review Process in 1973.) Such involvement by Canada in U.S.-Canadian electricity exchanges appears to preclude such exchanges from being considered actions subject to the EO. The EO, however, is ambiguous and should be revised to clarify its intent not to apply to actions in foreign nations which have their own environmental assessment procedures.

LAND USE

Land use restrictions present obstacles to U.S.-Canadian power and energy exchanges because acquisition of transmission line rights-of-way at fair cost is often impeded. The time element and uncertainty associated with land use conflicts causes economic penalties which must be absorbed by utility rate-payers when landowners require and receive premiums above the fair market value of their properties. Potential difficulties associated with line routings and jurisdictional border crossings occur when Federal and State agencies are concurrently involved in designating acceptable transmission corridors and

extensive coordination is required to insure that all line segments will connect. These problems, although not insurmountable, result in increased time delay which extends the lead time and cost required for successful project completion.

FINANCIAL

Financing of these projects is an obstacle due to the uncertainty and delays of obtaining the numerous and redundant permits and approvals. An economic penalty is imposed on U.S.-Canadian interconnections by the additional costs of obtaining the necessary regulatory approvals which are further encumbered by the cost of time delays.

PUBLIC ACCEPTANCE

General lack of public acceptance relative to major projects of this type presents one of the greatest obstacles affecting increased transmission interconnections with Canada. Recent experience with large bulk transmission projects has reflected increased levels of vandalism and protest which local law enforcement agencies have been unable and in some cases unwilling to effectively control. Such actions have created excessive delays such as recently have occurred in Minnesota with attendant cost increases and uncertainties regarding future commitments.

Item 7: "Suggest procedures to resolve obstacles. Recommend action by government (federal, provincial, state), utilities, regulatory bodies, others."

Positive measures which would eliminate or diminish the effects of obstacles to U.S.-Canadian interconnections can be implemented. The most significant obstacles for which reasonable solutions exist are related to overlapping jurisdiction, multiplicity of permit requirements, and uncoordinated environmental impact evaluations. Improvements in these areas would inherently reduce uncertainty, delays and cost. A secondary benefit would result from expeditious identification of those projects which are most beneficial, thus enabling governmental agencies and utilities to present the positive aspect of such projects thereby gaining public support.

These obstacles can be removed or substantially reduced without sacrificing the detailed analyses necessary to determine whether U.S.-Canadian interconnections are in the public interest and within acceptable environmental criteria by enacting Federal legislation which would provide the Department of Energy (DOE) with exclusive jurisdiction over facilities for the exchange of electricity with other nations. A proposal for such legislation which would provide for DOE to determine whether any international project for exchange of power is in the public interest. This law would provide for DOE preparation of environmental impact statements, route selection (after consultation with the affected States and other interested parties), authority to grant rights-of-way over Federal lands, and authority to approve structures over navigable waterways. An important facet of this legislation would be the ability of the DOE to grant Federal right of eminent domain for approved projects which involve transmission facilities in several states, thus diminishing right-of-way states,

thus diminishing right-of-way acquisition and land use obstacles by taking positive steps in guaranteeing that land will be acquired without detrimental time delays when DOE requirements have been met.

The "lead agency" concept embodied in existing CEQ guidelines and proposed regulations should be utilized to circumvent delays caused by a multiplicity of agencies involved in environmental impact assessments and other permit requirements. The DOE, or one single agency, should become the "lead agency" on projects for the exchange of power with Canada and should subsequently expedite the preparation of environmental impact statements and any other necessary documents to reduce the time required to obtain other governmental approvals.

The draft Executive Order discussed in Item 6 above could impose additional obstacles to U.S.-Canadian power and energy exchange. Efforts must be taken to clarify this order and to exempt U.S.-Canadian transactions and interconnections from U.S. assessment of the environmental impact of such projects in Canada. U.S. environmental laws should only be applied to this country since the elected Canadian officials are responsible for formulation of legislation applicable to their needs.

Manitoba Hydro agrees with the MARCA Regional Study on opportunities for expanded Canadian/U.S. electricity exchanges, and would add that on the Canadian side, from the experience of three interconnection export applications, we consider the procedures of National Energy Board approval to be necessary, satisfactory, and in the best interest of Canada. While it is true that additional costs are applied to the project due to application and hearing

procedures, and environmental studies, our experience indicates that these are now not unreasonable.

One area that has not been exposed to the public is the construction of hydraulic generating stations for export purposes in advance of Manitoba's own needs. With this kind of proposal, Manitoba Hydro would have to ensure that there is no added burden to the ratepayers and, in fact, there should be a sufficient margin of profit to make the venture attractive to ratepayers. We will not know what public reaction there would be to this form of export until proposals are made known.

Item 8: "Appendices - provide documentation or references to statistical and other data as necessary to support Items 1 to 7."

Reference Item 6

Footnote A) Presidential Executive Order No. 10485 (3, September, 1953) as amended by Executive Order No. 12038 (3, February, 1978)

Reference Item 6

Footnote B) Federal Power Act, Section 202(e) administered by the Secretary of Energy pursuant to the Department of Energy Organization Act (PL95-91, 1977).

Reference Item 6

Footnote C) National Environmental Policy Act of 1969 (NEPA) 42 USC 4321 et seq.

Department of Energy

Bonneville Power Administration

P.O. Box 3621

Portland, Oregon 97208

OFFICE OF THE ADMINISTRATOR

In reply refer to: **A**

JAN 4 1979

**Dr. Charles A. Falcone
Director of Power Supply and Reliability
Economic Regulatory Administration
Department of Energy
Washington, D.C. 20461**

Dear Dr. Falcone:

Transmitted herewith is the Western Region's report "Study of Opportunities for Expanded Canada-United States Exchange of Electricity," prepared under the aegis of the Western Systems Coordinating Council.

The Western Systems Coordinating Council encompasses 14 States: Washington, Oregon, Idaho, Montana west of the Continental Divide, California, Nevada, Utah, Arizona, Wyoming, Colorado, New Mexico, the El Paso environs of Texas, western South Dakota, and western Nebraska. The Council also includes the Canadian Province of British Columbia and will soon add Alberta.

The Council requested that Ray Foleen of the Bonneville Power Administration coordinate the preparation of the Western Region's report. Participating with him in this preparation on the U.S. side were Messrs. Kropitzer, Schaufelberger, and Dean, all from BPA. Mr. H. J. Goldie of British Columbia Hydro and Power Authority directed the efforts on the Canadian side. Also involved from Canada were Messrs. Forrest and Hayden of B.C. Hydro, and Mr. W. L. Fraser, Calgary Power. The report has been reviewed by all members of WSCC.

The report generally describes the existing interconnections between Canada and the United States in this region. They consist of four high-voltage lines of the Bonneville Power Administration on the U.S. side and of B.C. Hydro and Cominco Ltd. on the Canadian side. No further interconnections are planned. Indeed, interchange between Canada and the United States is limited by transmission capacity within each country and not by the interconnections themselves.

Mainly, there were five types of transactions between Canada and the United States during the past several years: firm sales, interruptible sales, exchanges, deliveries in accordance with the Columbia River Treaty, and wheeled power.

In reviewing the impediments to increased electricity exchanges, the problems appear to be common to the two countries. Construction of generation and transmission in either Canada or the United States to provide power for the other country would encounter strong opposition. Environmental and land use problems and political considerations all militate against facilities constructed to increase the export of electric power.

Should the political climate and public attitudes change, there is undoubtedly a large potential for increased exchanges of power, particularly from Canada to the United States. This would be achieved mainly from further hydro and coal development in British Columbia and Alberta. Increased markets could be found for Canadian power in the U.S. by availing ourselves of one or more of the following: construction of a second d-c intertie line from the Pacific Northwest to the Pacific Southwest, increasing the capacity of the existing d-c line, or construction of a third a-c line.

It should be kept in mind that the geographical region covered by this report is vast and there is great diversity in the generation of electricity and its consumption. In the Provinces of British Columbia and Alberta, and in the Pacific Northwest, most of the existing sources of generation are hydro, while in the Pacific Southwest and the Mountain States fossil fuel is generally used to produce electricity. Canada and the Pacific Northwest experience a winter peak while the Southwest peaks in the summer. These and other factors offer an even greater potential for vertical exchanges north and south than exist today.

Sincerely,

Ray Foleen
Deputy Administrator

H. J. Goldie
Manager, System Engineering Division
British Columbia Hydro and Power Authority

Enclosure:
Study of Opportunities for
Expanded Canada-United States
Exchange of Electricity

exchange and the storage of energy in reservoirs. Deliveries between countries do not always balance because of the spill of stored energy, carryover of balances from year to year, and the existence of some balances on July 31, 1978.

- d. Treaty Deliveries--This category includes deliveries of energy between Canada and the United States as required or permitted under the Columbia River Treaty.
- e. Wheeled Power--This category includes only power which was wheeled for Canadian utilities by BPA between two of the international interconnections.

STUDY OF OPPORTUNITIES FOR
EXPANDED CANADA-UNITED STATES EXCHANGE OF ELECTRICITY
(WESTERN REGION)

1. Existing Interconnections

In the western region, the only Canada-United States interconnections are between British Columbia and Washington. British Columbia Hydro and Power Authority and Bonneville Power Administration are connected by: (1) two 500-kV circuits at Blaine, Washington, and (2) a 230-kV circuit at Boundary, Washington. Also, Cominco Ltd. and BPA are connected by a 230-kV circuit (operated by West Kootenay Power and Light Company) at Boundary, Washington. There are other interconnections of much lower voltage that are not relevant to this paper.

The total transfer capability is less than the sum of the circuit capabilities due to stability considerations and limitations during line outage conditions. The maximum transfer capability is presently considered to be approximately 2,000 MW.

2. Planned Interconnections

There are no firm or tentative plans for additional interconnection capacity between those parts of the two countries encompassing British Columbia and the western United States (equivalent to the WSCC area). The possibility does exist, conversely, that the construction of certain large thermal plants in the U.S. Pacific Northwest will reduce BPA's power transfer capability from north to south to about 1,500 MW of firm transfer capability. Increased

transmission usage within the B.C. Hydro system could limit the future interconnection capability even further unless the system is specifically designed for export.

3. Transaction Types

Types of transactions between Canada and the United States at the international interconnections listed in section 1 during calendar years 1975, 1976, 1977, and January 1 to July 31, 1978, were as follows:

- a. Firm Sales--During the 1975-1978 period, these sales consisted only of short-term firm sales extending for not more than 5 months beyond the date of execution of the sales agreements.
- b. Interruptible Sales--Large quantities of energy were sold during the 1975-1978 period, mostly from Canada to the United States. These sales represented for the most part an opportunity for the seller to market hydroelectric energy for which there would not otherwise have been a market and an opportunity for the purchaser to fill reservoirs or to replace the operation of higher cost or less desirable resources.
- c. Exchanges--This category includes all deliveries made for the purpose of using the capabilities of the generating systems in the other country to increase the ability of the combined generating systems to serve loads. There are a large number of different transactions, but they consist mainly of emergency

4. Magnitude of Transactions ^{1/}

The magnitude of transactions between Canada and the United States at the international interconnections listed in Section 1 during calendar years 1975, 1976, 1977, and January 1 through July 31, 1978, were as follows:

<u>Transaction Types</u>	<u>1975</u> (Gigawatthours)		<u>1976</u> (Gigawatthours)		<u>1977</u> (Gigawatthours)		<u>Jan. to July 1978</u> (Gigawatthours)	
	<u>Canada</u> <u>to U.S.</u>	<u>U.S. to</u> <u>Canada</u>	<u>Canada</u> <u>to U.S.</u>	<u>U.S. to</u> <u>Canada</u>	<u>Canada</u> <u>to U.S.</u>	<u>U.S. to</u> <u>Canada</u>	<u>Canada</u> <u>to U.S.</u>	<u>U.S. to</u> <u>Canada</u>
Firm Sales	27	0	0	0	1,202	0	136	0
Interruptible Sales	850	273	1,931	25	3,767	0	1,205	76
Exchanges	67	77	51	214	944	889	151	667
Treaty Deliveries	1,078	0	0	0	36	71	12	17
Wheeled Power	860	843	2,054	2,014	453	453	365	365

^{1/} The figures were prepared by Bonneville Power Administration and do not necessarily represent accurately Canadian records. They are provided to illustrate order of magnitude.

5. Obstacles to Increased Electricity Exchange

a. Jurisdictional

Canada: Construction of certain Canadian projects would require development agreements between numerous jurisdictions. Some would involve Provincial and Federal cooperation; others would involve United States waters not covered by the International Joint Commission and would likely require specific treaty negotiations between Canada and the United States.

U.S.: There is no present demand for firm power from the U.S. in the Canadian market so that access is not an issue.

b. Regulatory

Canada: Increased transactions would likely require increased latitude and major changes in export licenses.

U.S.: Federal power agencies have no present regulatory obstacles but they could be included in future regulations if national energy policy so warranted. Non-Federal utilities would be subject to regulatory clearances.

c. & d. Environmental and Land Use

Canada: Increasing challenges by environmental organizations have made construction of generation, even where needed

in Canada, difficult and time-consuming. Building for export would intensify opposition by these groups and by land use planners as well. In addition to these problems, court actions are another recourse available to opponents of plant and transmission line construction.

U.S.: In common with the problems shared with Canada, utilities and Federal agencies in the U.S. are subject to challenges by environmental organizations and court actions. Lengthy delays and resulting increased costs are the least that can be expected for plants and transmission constructed to send power north to Canada.

e. Financial

Canada and U.S.: The construction of generating plant and transmission in advance of internal need or dedicated for some longer period could have major financial obstacles greater than normal, unless it could be demonstrated that there were long-term economic benefits to either country. Thermal generation has been subjected to enormous inflationary pressures which have strained the financial position of the utilities. Increasing generation to make power available for export would exacerbate this situation.

f. Political

Canada: To have any reasonable possibility of achieving public acceptance, both the Federal and Provincial Governments would need to move from a basically neutral position on export of electrical energy to a positive position in favor. This would be even more critical if a non-renewable resource such as coal were being consumed in order to provide energy to the U.S.

U.S.: The States of the Pacific Northwest would resist increased deliveries to Canada if it deprived the States of needed power. In addition, there is a well defined hostility in most of the States, on the part of single-issue oriented groups, to construction of generating plants, the output of which will not be used in the States where they are to be located.

g. Public Acceptance

Canada: To increase transactions would require the construction of generation facilities in advance of load requirements. At license hearings and public meetings on new generation facilities, there has been strongly expressed opposition to building plant just for export. For example, B.C. Hydro has had to justify the facilities based strictly on internal needs for firm energy.

As well as the generation plant requirement, any major increase in existing total export level would likely require additional transmission capability both internally and externally. These, of course, would meet the same opposition as the generating facilities.

U.S.: Export of power on a firm or long-term basis to Canada would be difficult if not impossible to explain in the Northwest, with forecasted deficits over the next 10 years. As in Canada, opposition to construction of generation and transmission facilities for power exports can be expected.

6. Opportunities for Additional Transactions

- a. It is unlikely that any significant amounts of firm energy from British Columbia would be available through 1987 although small amounts (i.e., possibly up to 200 Av. MW) might be offered for periods normally less than 1 year in advance.

Beyond 1987 it is possible that new generation facilities could be developed ahead of B.C.'s domestic requirements. The sources of supply would be hydro energy (up to 200 Av. MW per year) and coal-fired thermal until about 1991. After that date, it might be possible that some hydro projects on northern B.C.

rivers such as the Iskut, Stikine, and Liard could be developed to provide part of its energy output for an export market.

The potential maximum amounts available for export could be in the range of 300 Av. MW per year up to 1990, possibly rising to 1,000-1,500 Av. MW by 1994.

- b. By 1983 there will be a 500-kV interconnection between B.C. and Alberta. For a few years, the surplus energy available from Alberta would be in the order of 2000 GWh per year. The major portion of this energy will only be available in the period 11 p.m. to 5 a.m.; however, it would be reasonably firm. Some limited amounts of energy will be available during the remaining hours of the day.

Beyond 1986 it would be possible to advance coal-fired thermal generation facilities ahead of Alberta's domestic requirements. Such capacity would be in unit sizes of 375 MW and have an annual capacity factor of 80 percent.

Two hydro projects currently under investigation having a potential of 490 and 910 Av. MW are a possibility in the early 1990's. If these two projects ultimately appear viable, they could be considered for development ahead of the time period where they would be required within Alberta, and thus provide energy for export.

- c. To take advantage of the full exchange potential, as described in a. and b. above, additional transfer capability should be investigated.
- d. A second d-c intertie line from The Dalles, Oregon, to the Phoenix, Arizona, area and Hoover Dam has been under study and would be attractive to the Southwest if it were assured of a firm power supply. To accomplish this and provide a market for Canadian power, the Canadian utilities could construct generation in advance of their own needs, as mentioned in paragraphs a. and b. above, presumably with appropriate pullback conditions to satisfy load growth in Canada. If such power were available from Canada, it would enhance the existing interest in increasing the interconnection capacity of the 500-kV a-c lines and the existing 800-kV d-c line between the Pacific Northwest and California. These lines would also provide for increased surplus sales from the Canadian hydro resources during better than critical hydro conditions.
- e. The potential of energy center developments in the United States could provide short-term surpluses available for export to Canada. Otherwise, it is unlikely that firm energy will be available for export to Canada. In some water conditions when streamflows in the U.S. Pacific Northwest are above average, and streamflows in B.C. are below average, surplus hydro energy from the U.S. may be available for storage in B.C. Hydro reservoirs.

- f. Development of generation in Alaska for markets in the U.S. could require planning and construction of a coordinated electrical transmission network between Alaska, the Yukon, British Columbia, and the Pacific Northwest States.

September 28, 1978
Revised December 12, 1978

Department Of Energy

Alaska Power Administration
P.O. Box 50
Juneau, Alaska 99802

December 21, 1978

Mr. Charles A. Falcone, Director
Power Supply and Reliability
Economic Regulatory Administration
1111 20th St., Vanguard Bldg.
Washington, DC 20461

Dear Mr. Falcone:

As requested in your November 29 letter, we are enclosing the brief Alaskan report which we prepared as input to the US/Canada Electricity Exchange Study. The report was prepared by myself and Mr. Don Shira who is Chief of the APA Planning Division.

The report provides some notes on the power situation in Alaska and discusses concepts of possible future electric power interconnections between Alaska and neighboring areas in Canada, that is the Yukon Territory and Northern British Columbia. The report generally follows items one through six of the terms of reference for the study. Main points brought out include:

1. Power systems in Alaska and neighboring areas of Northern Canada have thus far developed independently because of (a) relatively small demands and (b) distance and terrain aspects.
2. There are at present no plans for new interconnections across the Alaska-Canada border.
3. Alaskan power demands continue to increase quite rapidly along with population increases and economic developments. The increasing demands have brought about significant expansion of in-State generation and transmission systems.
4. Interconnection concepts that may prove attractive include:
 - (a) Interconnections between neighboring systems to facilitate use of essentially local power resources;
 - (b) Interconnections associated with major resource developments. Possibilities include:
 - (1) Major hydroelectric development on either side of the border.
 - (2) Bulk transmission lines to facilitate energy transfer from northern sources to load centers in Southern British Columbia and the Pacific Northwest.
 - (3) Electrification of the Alcan natural gas pipeline.

5. There are excellent hydroelectric and coal resources which could provide needed power for future interconnected systems.

In response to a separate request from Mr. Bart Jackson, we are enclosing some rough estimates of Alaskan power demands through 1990 and resources to meet these demands. The figures for power demands are extrapolated from recent APA studies for the Alaska Railbelt area including some very general assumptions for power demands in other parts of the State. The figures for resources reflect on estimates of needed capacity and are not based on specific commitments or plans for new capacity.

Please let us know if you would like additional input from us for your study.

Sincerely,

Robert J. Cross
Administrator

Enclosures

cc: Mr. Dan Ogden
Mr. J. Emerson Harper

ALASKA ELECTRIC POWER DEMANDS AND RESOURCES

Estimated Power Demands

	1977		1978		1979		1980	
	MW	GWH	MW	GWH	MW	GWH	MW	GWH
Utility	616	2,828	690	3,160	760	3,500	840	3,840
Industrial	328	889	390	1,070	450	1,250	500	1,430
National Defense	142	547	140	550	140	550	140	550
Total	1,086	4,264	1,220	4,780	1,350	5,300	1,480	5,820

	1981		1982		1983		1984	
	MW	GWH	MW	GWH	MW	GWH	MW	GWH
Utility	900	4,150	970	4,460	1,040	4,790	1,110	5,080
Industrial	560	1,590	610	1,750	670	1,920	710	2,060
National Defense	140	550	140	550	140	550	140	550
Total	1,600	6,290	1,720	6,760	1,850	7,260	1,960	7,690

	1985		1986		1987		1990	
	MW	GWH	MW	GWH	MW	GWH	MW	GWH
Utility	1,170	5,390	1,260	5,800	1,350	6,200	1,620	7,430
Industrial	770	2,220	830	2,430	900	2,650	1,100	3,270
National Defense	140	550	140	550	140	550	140	550
Total	2,080	8,160	2,230	8,780	2,390	9,400	2,860	11,250

Resources Needed-Installed Capacity

	1977	1987	1990
	MW	MW	MW
Utility	1,049	2,310	2,760
Industrial	357	1,020	1,260
National Defense	198	200	200
Total	1,604	3,530	4,220

Prepared By
Alaska Power Administration
December 1978

OUTLINE OF ALASKAN INPUT FOR
U.S.-CANADA ELECTRIC POWER EXCHANGE STUDY

This outline follows terms of reference one through six.

Synopsis

Alaska shares 1,538 miles of common border with Canada's Yukon Territory and the Province of British Columbia. Alaska and neighboring parts of Canada are characterized as frontier areas with few people, relatively little development, and great potential for the future.

Activities conducted across the border are generally concentrated along a few natural transportation routes--a handful of passes and river valleys that cross the rugged coastal mountains in Southeast Alaska and the main river valleys in the Yukon River Basin.

Power systems on both sides of the border have developed independently. Long distances, sometimes difficult terrain, and comparatively small power demands have outweighed potential advantages of interconnected systems.

Alaskan power demands have been growing rapidly along with significant expansion of in-State generation and transmission systems. Further expansion of Alaskan power systems, together with major northern resource developments could lead to circumstances favoring interconnection between power systems serving the Alaska Railbelt, the Yukon Territory, parts of Southeast Alaska, and northern British Columbia.

Hydroelectric and coal resources are major options for future Alaskan power resources. Existing hydroelectric development amounts to only one-half of 1 percent of the identified potential. A large hydroelectric development (1,500 MW) is proposed for the Upper Susitna basin with service to the Anchorage and Fairbanks areas. Southeast Alaska has an

abundant resource of smaller hydroelectric potentials, some of which are under consideration for near future development. Coal now provides a significant portion of the power supplies for the Fairbanks area and a sizable expansion (100 MW) is expected by about 1985.

1. Interconnections now in service.

B.C. Hydro owns the power distribution system in Hyder, Alaska (population approximately 50). Hyder is connected by road to Stewart, B.C., an active mining community. Hyder is completely isolated from other Alaskan communities.

2. Firm and tentative plans for additional interconnection capacity.

None.

3. Types of transactions that take place, existing interconnections.

B.C. Hydro provides utility service in Hyder, Alaska.

4. Magnitude of transactions, existing interconnections.

Small.

5. Reasons and obstacles that inhibit Alaska-Canada electrical interchanges.

Alaska and neighboring areas of Canada have relatively few people and the resources are relatively undeveloped. Long distances, sometimes difficult terrain, and comparatively small power demands have discouraged interconnections across the border.

6. Opportunities for future interconnections.

Alaskan power demands have been increasing rapidly as a result of substantial expansion of the State's economy. Table 1 summarizes power demands and installed capacity for 1977.

Net generation figures for 1965, 1975, and 1977 illustrate the trend:

Alaska Net Generation, GWH

	<u>1965</u>	<u>1975</u>	<u>1977</u>
Utilities	720	2,300	2,828
Non-Utilities	<u>919</u>	<u>1,000</u>	<u>1,474</u>
Total	1,639	3,300	4,302

It is expected that power demands for most Alaskan systems will continue to grow quite rapidly for the foreseeable future.

Substantial regional power systems are developing for the major load centers in Alaska: Anchorage and neighboring communities surrounding Cook Inlet and the Fairbanks area. These two power market areas account for 81 percent of Alaskan utility power demands in 1977. There is high probability that these two market areas will be interconnected within the next 10 to 20 years.

General locations of existing power facilities in Alaska, the Yukon Territory, and Northern B.C. are shown on the location map.

The following notes discuss concepts of possible future Alaska-Canada interchanges. The alternatives generally fall into two categories:

--Interconnection between neighboring systems to facilitate use of essentially local power resources. Needed transmission capacity would be relatively small.

--Interconnection associated with major resource developments. These could lead to substantial power flows across the border.

Haines-Skagway-Yukon Territory

Haines and Skagway are now important transportation access points to the Yukon Territory. Existing road and rail systems would facilitate transmission line construction. Transmission distances to tie in with the Northern Canada power system at Haines Junction and Carcross are relatively short. A future transmission line between Haines and Juneau may eventually prove feasible. Potential power sources include hydroelectric resources on both sides of the border.

Present power demands in Haines and Skagway are very small, and this argues against feasibility for the interconnection. However, any significant resource or industrial development would enhance feasibility of these potential interconnections.

Approximate transmission distances involved are as follows:

Haines, AK to Skagway, AK	15 miles
Skagway, AK to Carcross, YT	60 miles
Haines, AK to Haines Junction, YT	150 miles
Juneau, AK to Haines, AK	90 miles

Underwater transmission would likely be used for most of the Haines-Skagway line and much of the Juneau-Haines line.

Among the factors that would bear on this interconnection plan are:

- o Available surplus power in the Juneau area from the Alaska Power Administration's Snettisham Project.
- o Present dependency on deisel fuel for power supplies at Haines and Skagway.
- o Potential new demands such as industrial development at Haines and Skagway or electrification of the White Pass and Yukon Railroad.
- o Possible Alaskan markets for hydro power produced in the Yukon Territory.

Other Potential Interconnections involving Southeast Alaska

The city of Ketchikan, Alaska, is within approximately 80 transmission miles from the existing B.C. hydro power system. Conceptually, an underwater dc intertie would enable Ketchikan to purchase power from B.C. Hydro. Such a tie might also facilitate development of local hydro resources in the vicinity of Ketchikan.

Hydroelectric resources in British Columbia's Stikine River basin are situated relatively close to the Alaskan communities of Petersburg and Wrangell. If the B.C. resources are developed, both Petersburg and Wrangell would be potential power customers.

Long range consideration also includes the potential development of a regional transmission system for Southeast Alaska extending from Ketchikan to Skagway, including service to Petersburg, Wrangell, Juneau, and Haines. This type of system would encourage development of strong interties with the Canadian system.

Interconnections Associated With Major Resource Development

Three general concepts have been identified in existing studies:

- (1) Major hydroelectric development.
- (2) Bulk transmission facilities to facilitate energy transfer from northern sources to load centers in southern British Columbia and the Pacific Northwest.
- (3) Electrification of the Alcan Natural Gas Pipeline.

There are excellent resources of undeveloped hydroelectric power in Alaska, the Yukon Territory, and northern British Columbia. Any significant power development on either side of the border would encourage consideration of interconnections.

It would be technically feasible to transport large amounts of power generated in Alaska and neighboring areas of Canada to major load centers in southern Canada and the Pacific Northwest. Such a plan may be of interest in connection with major hydroelectric development or large thermal plants. Transmission technology does not appear to be a major limiting factor.

Conceptually, electrification of portions of the Alcan Natural Gas Pipeline is attractive as a measure to conserve the gas that would otherwise be used for pumping and refrigeration stations, and to facilitate development of regional power systems. Potential power sources include hydro and coal in both Alaska and Canada. Gas savings would be significant, and preliminary studies indicate a reasonable chance that the gasline electrification plan would be feasible. There are substantial barriers in terms of timing, large initial investment, and the departure from conventional gasline construction practices.

Obstacles

Low levels of development, small population, long distances, and terrain factors have thus far precluded significant electrical interties between Alaska and Canada. The distances begin to look much smaller along with expansion of regional economics and evolution of regional power systems.

Environmental questions will certainly arise along with any future interconnection proposals. Pending proposals for wilderness areas and other conservation set asides in Alaska blanket several natural transportation corridors.

Table 1. Alaska Generating Capacity and Power Demand--1977

Relative Size of Alaska Power Systems
1977

	Installed Capacity MW	Net Generation KWH x 10 ⁶	Peak Demand MW
Utility	1,046	2,828	616
National Defense	180	491	126
Industrial & Misc.	403	983	339
Total	1,629	4,302	1,081

Utility Power Market Areas
1977

Area	Peak Demand MW	Net Generation KWH x 10 ⁶	Generation %
Anchorage-Cook Inlet	412	1,805	63.8
Fairbanks-Tanana Valley	118	482	17
Juneau	25	119	4.2
Ketchikan	16	81	2.9
Kodiak	10	54	1.9
Sitka	9	42	1.5
Balance of State	26	245	8.7
Totals	616	2,828	100